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PT-90 A
16/9
CHASSIS

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TECHNICAL DATA

CRT PANEL	
Visible Picture Deflection Angle	28" / 106° / 66 cm 110° 32" / 106° / 76 cm.
Vertical Frequency	50Hz
Horizontal Frequency	15.625Hz

ELECTRONIC

Program Number	100+AV
Teletext	Flof text
Tuner	Cable tuner - 8 MHz spacing for Hyper Band
TV System	European CCIR system
Music Power	110° 2x8 Watt Rms 10% distortion

CONNECTIONS

Euro AV Socket	Include

MAIN STAGE

Mains Voltage	165-260VAC
Mains Frequency	50Hz
Power Consumption	28", 32" 126 Watt
In Stby Mode	28", 32" 8 Watt

RECOMMENDATION FOR SERVICE REPAIRS

1- Use only original spare parts. Only use components with the same specifications for replacement.
2- Original fuse value only should be used.
3- Main leads and connecting leads should be checked for external damage before connection.
   Check the insulation.
4- Parts contributing to the safety of the product must not be damaged or obviously unsuitable.
   This is valid especially for insulators and insulating parts.
5- Thermally loaded solder pads are to be sucked off and re-soldered.
6- Ensure that the ventilation slots are not obstructed.
7- Potentials as high as 25 KV are present when this receiver is operating. Operation of the receiver outside the cabinet or with back cover removed involve a shock hazard from the receiver.
   Servicing should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high voltage equipment.
   Perfectly discharge the high potential of the picture tube before handling the tube. The picture tube is highly evacuated and if broken.
   Glass fragments will be violently expelled.
   Always discharge the picture tube anode to the receiver chassis to keep of the shock hazard before removing the anode cap.
8- Keep wire away from the high voltage or high temperature components.
9- When replacing a wattage resistor in circuit board, keep the resistor 10 mm away from circuit board.

HANDLING OF MOS CHIP COMPONENTS

MOS circuit requires special attention with regard to static charges. Static charges may occur with any highly insulating plastics and can be transferred to persons wearing clothes and shoes made of synthetic materials. Protective circuits on the inputs and outputs of mos circuits give protection to a limited extend only due to time of reaction.

Please observe the following instructions to protect the components against damage from static charges.

1- Keep mos components in conductive package until they are used. Most components must never be stored in styropor materials or plastic magazines.
2- Persons have to rid themselves of electrostatic charges by touching MOS components.
3- Hold the component by the body touching the terminals.
4- Use only grounded instruments for testing and processing purposes.
5- Remove or connect MOS ICs when operating voltage is disconnected.

X-RAY RADIATION PRECAUTION

1- Excessive high voltage can be produce potentially hazardous X-RAY radiation. To avoid such hazard, the high voltage must not be above the specified limit. The nominal value of the high voltage of this receiver is 25KV at zero beam current (minimum brightness) under 220V AC power source. The high voltage must not under any circumstance, exceed 30KV. It is recommended the reading of the high voltage be recorded as a part of the service record. It is important to use an accurate and reliable high voltage meter.
2- The primary source of X-RAY radiation in this TV receiver is the picture tube. For continued X-RAY radiation protection, the replacement tube must be exactly the same type tube as specified in the part list.

SERVICE MENU

The service menu is entered by pressing a special 4-digit code if the feature menu is displayed and TV is in FE -mode. While TV isn't in AV Mode and featura menu is displayed, pressing sequence of digits 1923 will enter the TV to service mode and service menu will be displayed.

PT90 Option Tables

PT90 ST92195DS01-V1

Option 1

B0	1	B/G Available
	0	not available
B1	1	D/K Available
	0	not available
B2	1	I Avaialble
	0	not available
B3	1	L Available
	0	not available
B4-B5	0	TTX GROUP 1 (ENG, GER, SWE, ITA, FRA, SPA, CZH, RUM)
	1	TTX GROUP 2 (POL, GER, SWE, ITA, FRA, YUV, CZH, RUM)
	10	TTX GROUP 3 (ENG, GER, SWE, ITA, FRA, SPA, TUR, RUM)
	11	TTX GROUP 4 (ENG, GER, SWE, ITA, FRA, SPA, TUR, RUM)
B6-B7	0	Samsung
	1	Temic
	10	Philips UV1316
	11	Thomson/Orega

Option 2

B0	1	AV2 mode available
	0	not available
B1	1	SVHS mode available
	0	not available
B2	1	Volume Linear
	0	Volume Logaritmic
B3	1	Ecoswitch available
	0	not available
B4	1	Child Lock available
	0	not available
B5	1	Headphone available
	0	not available
B6	1	No Subwoofer
	0	Subwoofer available
B7	1	4/3 Picture tube
	0	16/9 Picture tube

Option 3

B0	1	One Crystal application (4.43 Mhz)
	0	2 cystal application (for NTSC play back)
B1	1	Intercarrier application
	0	QSS application
B2	1	APR available
	0	not available
B3	1	OSD contrast control ON
	0	OSD contrast control OFF
B4	1	disable
	0	Blue screen enable
B5	1	AVC Automatic Volume Correction (Stereo) AVL(Mono),
	0	not available
B6	1	DVD available
	0	not available
B7	1	Standby after power on
	0	No Standby after power on

PT90 ST92195DS01-V2

Option 1

B0	1	B/G Available
	0	not available
B1	1	D/K Available
	0	not available
B2	1	I Avaialble
	0	not available
B3	1	L Available
	0	not available
B4	1	Keyboard with menu
	0	Keyboard without menu
B5	1	Farsi Available
	0	not available
B6-B7	0	Samsung
	1	Temic
	10	Philips UV1316
	11	Thomson/Orega

Option 2

B0	1	AV2 mode available
	0	not available
B1	1	SVHS mode available
	0	not available
B2	1	Volume Linear
	0	Volume Logaritmic
B3	1	Ecoswitch available
	0	not available
B4	1	Reduce tone
	0	Reduce Volume (MSP Sound mode)
B5	1	Headphone available
	0	not available
B6	1	No Subwoofer
	0	Subwoofer available
B7	1	4/3 Picture tube
	0	16/9 Picture tube

Option 3

B0	1	One Crystal application (4.43 Mhz)
	0	2 cystal application (for NTSC playback)
B1	1	Intercarrier application
	0	QSS application
B2	1	MSP Carrier Mute On
	0	MSP Carrier Mute Off
B3	1	OSD contrast control ON
	0	OSD contrast control OFF
B4	1	disable
	0	Blue screen enable
B5	1	AVC Automatic Volume Correction (Stereo) AVL(Mono)
	0	not available
B6	1	DVD available
	0	not available
B7	1	Standby after power on
	0	No Standby after power on

PT90 ST92195DS01-V3

Option 1

B0	1	B/G Available
	0	not available
B1	1	D/K Available
	0	not available
B2	1	I Avaialble
	0	not available
B3	1	L Available
	0	not available
B4	1	Keyboard with menu
	0	Keyboard without menu
B5	1	Brightness full range available
	0	Brightness 75% range available (manual cut off)
B6-B7	0	Samsung
	1	Temic
	10	Philips UV1316
	11	Thomson/Orega

Option 2

B0	1	AV2 mode available
	0	not available
B1	1	SVHS mode available
	0	not available
B2	1	2248 Volume register max (DVD and Stereo chassis)
	0	Volume Logaritmic (mono chassis)
B3	1	Search mono audio ident available (auto ident for BG & DK)
	0	not available
B4	1	DVS Loader (Y/C)
	0	ESS and Zoran Loaders (RGB,CVBS)
B5	1	Headphone available
	0	not available
B6	1	No Subwoofer
	0	Subwoofer available
B7	1	4/3 Picture tube
	0	16/9 Picture tube

Option 3

B0	1	One Crystal application (4.43 Mhz)
	0	2 cystal application (for NTSC playback)
B1	1	Intercarrier application
	0	QSS application
B2	1	STV224XE (Uses extra features as RGB Peak limitation)
	0	The other video IC's (ST2248E included)
B3	1	OSD contrast control ON
	0	OSD contrast control OFF
B4	1	disable
	0	Blue screen enable
B5	1	AVC Automatic Volume Correction (Stereo) AVL(Mono).
	0	not available
B6	1	DVD available
	0	not available
B7	1	Standby after power on
	0	No Standby after power on

PT90 ST92195T01-H1 (Home Theatre)

Option 1

B0	1	B/G Available
	0	not available
B1	1	D/K Available
	0	not available
B2	1	I Avaialble
	0	not available
B3	1	L Available
	0	not available
B4	1	Keyboard with menu
	0	Keyboard without menu
B5	1	Brightness full range available
	0	Brightness 75% range available (manual cut off)
B6-B7	0	Samsung
	1	Temic
	10	Philips UV1316
	11	Thomson/Orega

Option 2

B0	1	AV2 mode available
	0	not available
B1	1	SVHS mode available
	0	not available
B2	1	APR available
	0	not available
B3	1	DVD mute pin option
	0	not available
B4	1	DVS Loader (Y/C)
	0	ESS and Zoran Loaders (RGB,C/BS)
B5	1	Headphone available
	0	not available
B6	1	No Subwoofer
	0	Subwoofer available
B7	1	4/3 Picture tube
	0	16/9 Picture tube

Option 3

B0	1	One Crystal application (4.43 Mhz)
	0	2 cystal application (for NTSC playback)
B1	1	Intercarrier application
	0	QSS application
B2	1	STV224XE (Uses extra features as RGB Peak limitation)
	0	The other video IC's (ST2248E included)
B3	1	OSD contrast control ON
	0	OSD contrast control OFF
B4	1	disable
	0	Blue screen enable
B5	1	AVC Automatic Volume Correction (Stereo) AVL(Mono),
	0	not available
B6	1	DVD available
	0	not available
B7	1	Standby after power on
	0	No Standby after power on

PT90 ST92195DSPHD1-V4 E

Option 1

B0	1	L Available
	0	not available
B1	1	not used
	0	not used
B2	1	no Pin 8 16:9 switching mode
	0	Pin 8 16:9 switching mode
B3	1	Turn on from AV enabled
	0	Turn on from AV disabled
B4	1	Keyboard with menu
	0	Keyboard without menu
B5	1	Brightness full range available
	0	Brightness 75% range available (manual cut off)
B6-B7	0	Samsung (TECC2949PS35 B(T), TECC2949PS35 P(T))
	1	Temic
	10	Philips UV1316
	11	Thomson/Orega

Option 2

B0	1	AV2 mode available
	0	not available
B1	1	SVHS mode available
	0	not available
B2	1	2248 Volume register max (DVD and Stereo chassis)
	0	Volume Logaritmic (mono chassis)
B3	1	not used
	0	not used
B4	1	DVD picture in CVBS mode
	0	DVD picture in RGB mode
B5	1	Headphone available
	0	not available
B6	1	No Subwoofer
	0	Subwoofer available
B7	1	4/3 Picture tube
	0	16/9 Picture tube

Option 3

B0	1	One Crystal application (4.43 Mhz)
	0	2 cystal application (for NTSC playback)
B1	1	Intercarrier application
	0	QSS application
B2	1	STV224XE (Uses extra features as RGB Peak limitation)
	0	The other video IC's (ST2248E included)
B3	1	OSD contrast control ON
	0	OSD contrast control OFF
B4	1	disable
	0	Blue screen enable
B5	1	AVC Automatic Volume Correction (Stereo) AVL(Mono),
	0	not available
B6	1	DVD available
	0	not available
B7	1	Standby after power on
	0	No Standby after power on

Option 4

B0	1	Home Cinema On
	0	Home Cinema Off
B1	1	Pip On
	0	Pip Off
B2	1	DVB T ON
	0	DVB T OFF
B3	1	TXT ON
	0	TXT OFF
B4	1	Not used
	0	Not used
B5	1	Not used
	0	Not used
B6-B7	0	Samsung (TECC2949PS35 B(T), TECC2949PS35 P(T))
	1	Temic
	10	Philips UV1316
	11	Thomson/Orega

GEOMETRY... (90 deg Chasis)
V.SIZE 4/3 50Hz
V.SIZE 16/9 50Hz
V.SIZE 4/3 60 Hz
V.SIZE 16/9 60 Hz
V. POS
H.POS

GEOMETRY... (110 deg Chasis with STV9306 IC)
V.SIZE
V.POS
V.C.CORR
V.S.CORR
H.SIZE
H. PINC.CORR
H. KEYS.CORR
H.COR.CORR
H. POS

VIDEO...
R GAIN
G GAIN
B GAIN
R CUTOFF
G CUTOFF

TUNER/IF...
AGC
PIF COARSE
PIF FINE
PIF C OARSE L'
PIF FINE L'

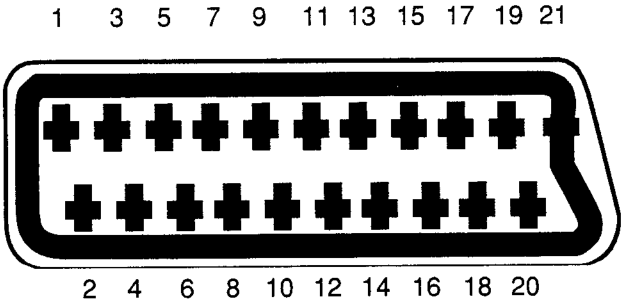
> : < is the VCO status indicator for adjusing the PIF to 38.9Mhz for BGDKIL and 33.9 for L' standards thru bus controlled VCO.

The VCO status is read from the read register of STV224X and guides whether to Increase / Decrease the VCO registers to attain VCO OK Status. I For doing VCO adjustment, Feed a 38.9MHz Carrier as IF input and adjust PIF Coarse and fine parameters to get VCO OK Status.

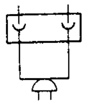
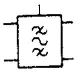
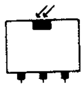
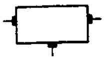
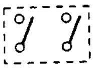
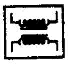
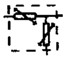
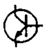
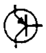
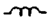
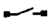
For doing VCO L1 adjustment, Feed a 33.9 MHz carrier as IF input and adjust PIF Coarse L' and PIF Fine L' to get VCO OK Status.

SPECIFICATIONS OF THE CONNECTOR
(EURO SCART)

1- Audio output 1. right channel 0.5 VRMS/<l k 0
2- Audio input 1. right channel 0.5 VRMS (connected to No.6)
3- Audio output 2. left channel 0.5 VRMS (connected to No.1)
4- GND (audio)
5- GND
6- Audio input 2. left channel 0.5 VRMS/>10k 0
7- RGB input, blue (B)
8- Switch signal video (status)
9- GND
10- Reserved for clock signals (not connected)
11- RGB input, green (G)
12- Reserved for remote control (not connected)
13- GND
14- GND switch signal RGB
15- RGB input, red (R)
16- Switch signal RGB
17- GND (video)
18- GND19- Video output 1 Vpp/75 ohm
20- Video input 1 Vpp/75 ohm
21- Shield



COMPONENT DESCRIPTIONS

	POWER CORD
	SAW FILTER
	IR SENSOR
	VOLTAGE REGULATOR
	ON/OFF SWITCH
	LINE FILTER
	PTC
	NPN TRANSISTOR
	PNP TRANSISTOR
	CERAMIC FILTER
	COIL
	LINEARITY COIL
	FUSIBLE RESISTOR
	IW METAL OXIDE RESISTOR
	1/2W METAL OXIDE RESISTOR
	1/4 OR 1/6W CARBON FILM RESISTOR
	CERAMIC CAPACITOR /POLYESTER CAPACITOR
	ELECTROLYTIC CAPACITOR
	DIODE
	ZENER DIODE
	SWITCH JUMPER
	NET (INPUT)
	NET (OUTPUT)
	TACT SWITCH

INTRODUCTION

PT90A is a low-cost multi-standard television receiver control system based on ST921x5 microcontroller family. It is a frequency synthesis tuning (FST) system with on-screen display (OSD) for all necessary control functions. The system is based on the I²C-bus controlled one-chip video processor IC STV224x, which can support a Nicam and a German stereo sound system based on MSP as well as mono sound.

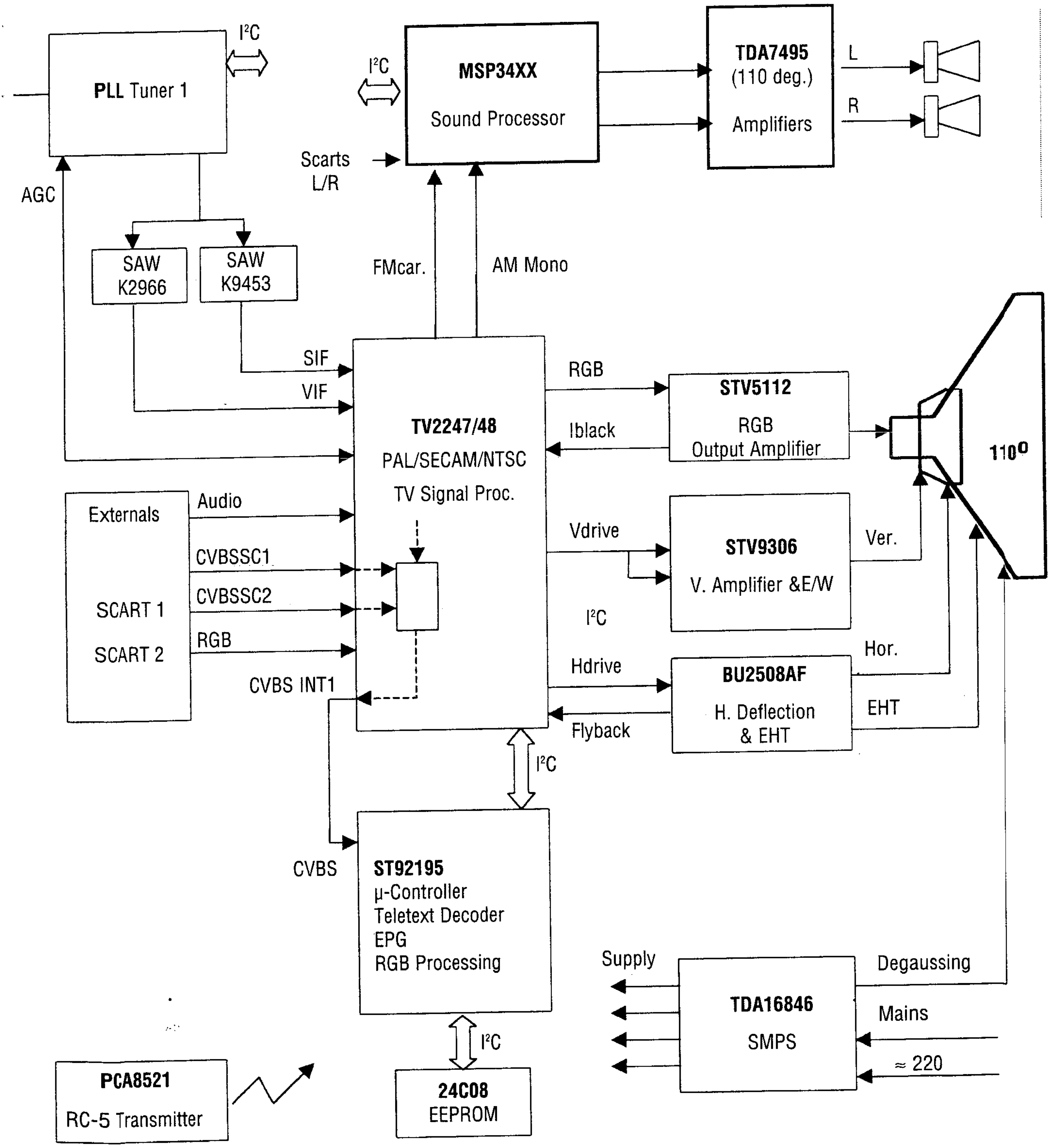
PT90A has the ability to control two scart connections, and headphone inputs.

Teletext is handled by the microcontroller on-chip teletext interface. The user-interface is menu-controlled for easy access with remote control or local keyboard keys.

1.1 Definitions, acronyms and abbreviations.

- ADC Analogue to Digital Converter
- AFC Automatic Frequency Control
- AV Audio Video peripheral TV signal source
- DAC Digital to Analogue Converter
- FE Front End(=normai TV) mode
- FST (PLL) Frequency synthesis Tuning (Phase Locked Loop)
- I²C Inter Ic bus, 2-wire, bidirectional multimaster bus
- IDENT Horizontal coincidence signal, transmitter IDENTification
- LS Loud Speaker
- HP Headphone
- MS Multi Standard
- NV-Memory Non-Volatile Memory
- OSD On Screen Display
- PP Personal Preference
- RC-5 Remote Control System, complying with RC-5 world standard
- Video Proc. STV223x, integrated I²C bus controlled multisystem one chip TV-processor
- PIF Picture Intermediate Frequency.
- SIF Sound Intermediate Frequency.
- NICAM Near Instantaneous Companded Audio Multiplex

PT90A 110° STEREO CHASSIS


PLL Tuner 1
I²C
AGC
SAW K2966
SAW K9453
I²C
MSP34XX
Sound Processor
Scarts L/R
FMcar.
AM Mono
TDA7495
(110 deg.)
Amplifiers
L
R
SIF
VIF
TV2247/48
PAL/SECAM/NTSC
TV Signal Proc.
RGB
Iblack
STV5112
RGB Output Amplifier
110°
Externals
Audio
CVBSSC1
CVBSSC2
RGB
SCART 1
SCART 2
CVBS INT1
Vdrive
STV9306
V. Amplifier &E/W
Ver.
I²C
Hdrive
Hor.
BU2508AF
H. Deflection & EHT
EHT
Flyback
I²C
CVBS
ST92195
μ-Controller
Teletext Decoder
EPG
RGB Processing
Supply
TDA16846
SMPS
Degaussing
Mains
≈ 220
I²C
24C08
EEPROM
PCA8521
RC-5 Transmitter

Basic Hardware Specification

The following are the components that a PT90A controlled system consists of;

- ST921x5 TV+OSD+(TXT) controller with PT90A software inside 24C08 1024*8 bit NV-Memory (EEPROM) for storage of favourite programmes,
- preffered sound and picture controls, service menu settings.
- STV224x I^2C bus controlled multi-standard one-chip TV-processor
- Pre-programmed RC-5 remote control transmitter
- Temic-Alps-Philips-Thomson-Orega PLL Tuners

- 110° Chasis
- STV9306 I^2C bus controlled vertical deflection and E-W correction circuit

For stereo systems the following optional device is supported MSPXX(D/G) German and NICAM stereo sound decoder. Communication between the microcontroller (master) and all related devices (slaves) is carried out by means of the two-wire bidirectional I^2C bus. This chapter describes all of the functions and hardware equirements of PT90A. The overall control of the system is handled by the microcontroller which performs the following;

- Decodes the serial data from the remote controller
- Scans the local keyboard
- Controls the OSD
- Exchanges information via the serial I^2C bus
- Selects the proper tuner, tuner band
- Selects the proper IF and the sound demodulator
- Analogue picture controls
- Switches between internal and external audio and video signals

5.1 Interface Description

5.1.1 Remote Control Handset.The remote control handset which is compatible with RC-5 standard.

5.1.2 Remote Control Decoding

The infrared remote control pulses are modulated at the standard RC-5 frequency of 36 KHz. The remote control signal (active HIGH) from the IR-receiver (TFMK1380T) is fed to the external interrupt input (IR-INPUT) of the microcontroller. Finally the video identification in STV224x is checked to make sure that the search terminated on a video carrier. For SECAM L' (France VHF) channel search starts with the highest channel frquency and all steps atre carried out in the reverse order. When micro search fails to find a signal in a channel, it will tune the standardised channel frequency.

Sound Systems

PT90A supports stereo sound system as well as mono both controlled via I^2C bus from the video processor (Sn/224x).

Mono Sound Sysfem

The only available sound control is volume. In FE-mode, after tuning a programme, the system always selects the sound witta the following priority.

AMSound

If a transmitter is tuned with colour standard SECAM L/L', the sound will be forced to AM.

The AM sound system is automatically forced via the STV224x when positive modulation (SECAM-L or SECAM-L' is selected.

Sfereo Sound Sysfem

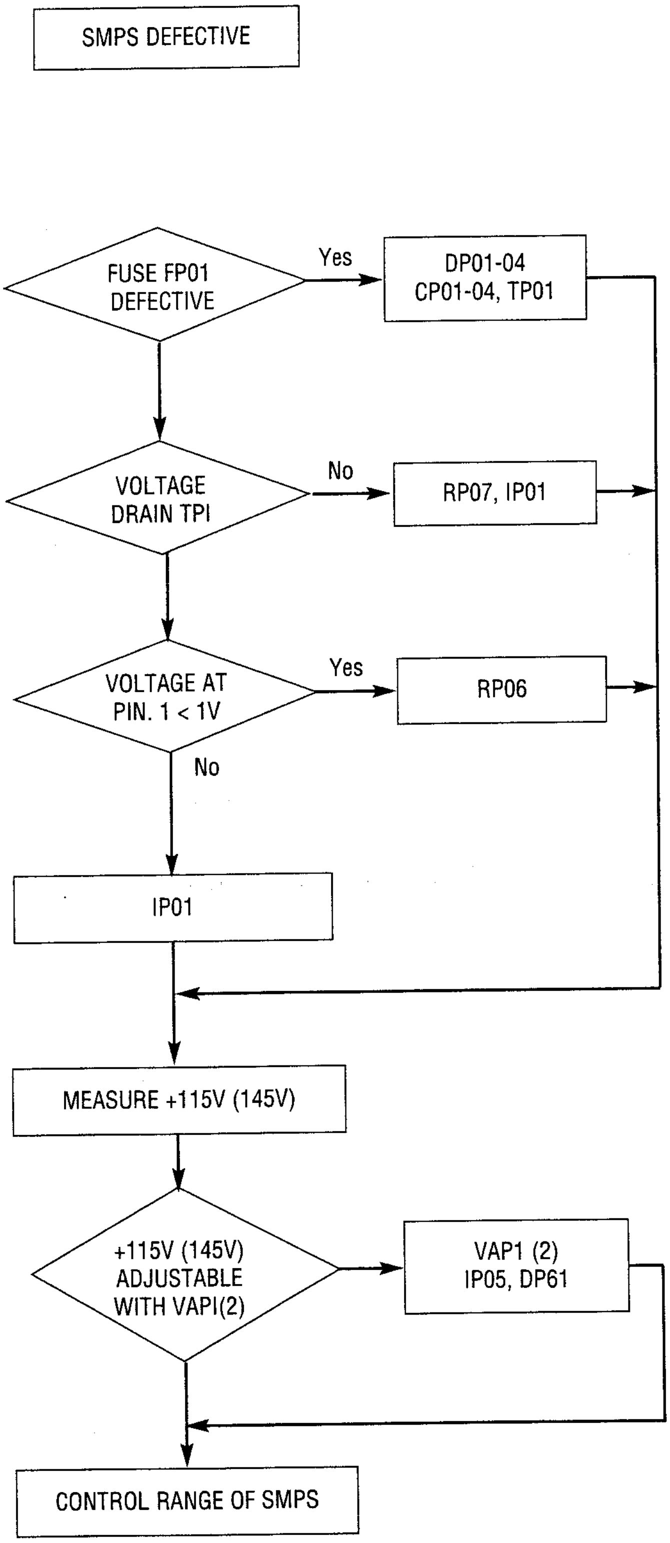
Direct control of the audio functions (on the remote transmitter as individual buttons) are;

personal preference function, volume, mute, mono/stereo/language

Automatic identification and decoding of German Stereo and NICAM sound systems

A. German Stereo (A2):	Mono / Stereo / Dual I / II
B. NICAM Stereo	Mono / Stereo / Dual I / II
C. Mono	Only mono

TROUBLESHOOTING GUIDE FOR SMPS


SMPS DEFECTIVE
FUSE FP01 DEFECTIVE
Yes
DP01-04
CP01-04, TP01
VOLTAGE DRAIN TPI
No
RP07, IP01
VOLTAGE AT PIN. 1 < 1V
Yes
RP06
No
IP01
MEASURE +115V (145V)
+115V (145V) ADJUSTABLE WITH VAPI(2)
VAP1 (2)
IP05, DP61
CONTROL RANGE OF SMPS

TROUBLESHOOTING GUIDE FOR MAIN PCB

TROUBLE	CHECK POINTS
No picture	FP01, RP01, DP01-04, TP01, ICV1, ICV2, RD10, RD01,TD02
No sound	DP12, IA0I, ICV1, IC01, CA10, CA11, ICM1, X800, R806
Sound distortion	IA01, CA05, ICV2
No color	ICV1, XV01, XV02, CV24
Dark picture	ICV1, ICV2, RV94, screen adj.
Horizontal size	CD03, CD04, CD05, LD01, CD06, ID21, DD22, +145V adj.
Verticable size	ID21, (ID41), CD26, CD44, RD10, RD17, DD07, DD08) RD29,RD50
Horizontal Linearity	LD03, RD14
Verticabie linearity	RD49, CD43
Noise picture	TU01, IF adj., AGC adj.
White screen	RD08, ICV2

ST921x5 Microcontroller

Microcontroller + OSD + (Teletext decoder) + VPS/PDC/WSS decoder are embeded in one chip, where there are two types with the major difference;

ST92185 No-teletext

ST92195 With teletext

The ST92195 microcontroller is developed and manufactured by STMicroelectronics using a proprietary n-well HCMOS process. Its performance derives from the use of a flexible 256-register programming model for ultra-fast context switching and real-time event response. The intelligent on-chip peripherals offload the ST9 core from I/O and data management processing tasks allowing critical application tasks to get the maximum use of core resources. The ST92195 MCU supports low power consumption and low voltage operation for power-efficient and low-cost embedded systems.

The advanced ST9+ Core consists of the Central Processing Unit (CPU), the Register File and the Interrupt controller. The general-purpose registers can be used as accumulators, index registers, or address pointers. Adjacent register pairs make up 16-bit registers for addressing or 16-bit processing. Although the ST9 has an 8-bit ALU, the chip handles 16-bit operations, including arithmetic, loads/stores, and memory/register and memory / memory exchanges. Two basic addressable spaces are available: the Memory space and the Register File, which includes the control and status registers of the on-chip peripherals. Power consumption of the device can be reduced by more than 95% (Low power WFI).

Up to 28 I/O lines are dedicated to digital Input / Output. These lines are grouped into up to five I/O Ports and can be configured on a bit basis under software control to provide timing, status signals, timer and output, analogue inputs, external interrupts and serial or parallel I/O. A set of on-chip peripherals form a complete system for TV set and VCR applications:

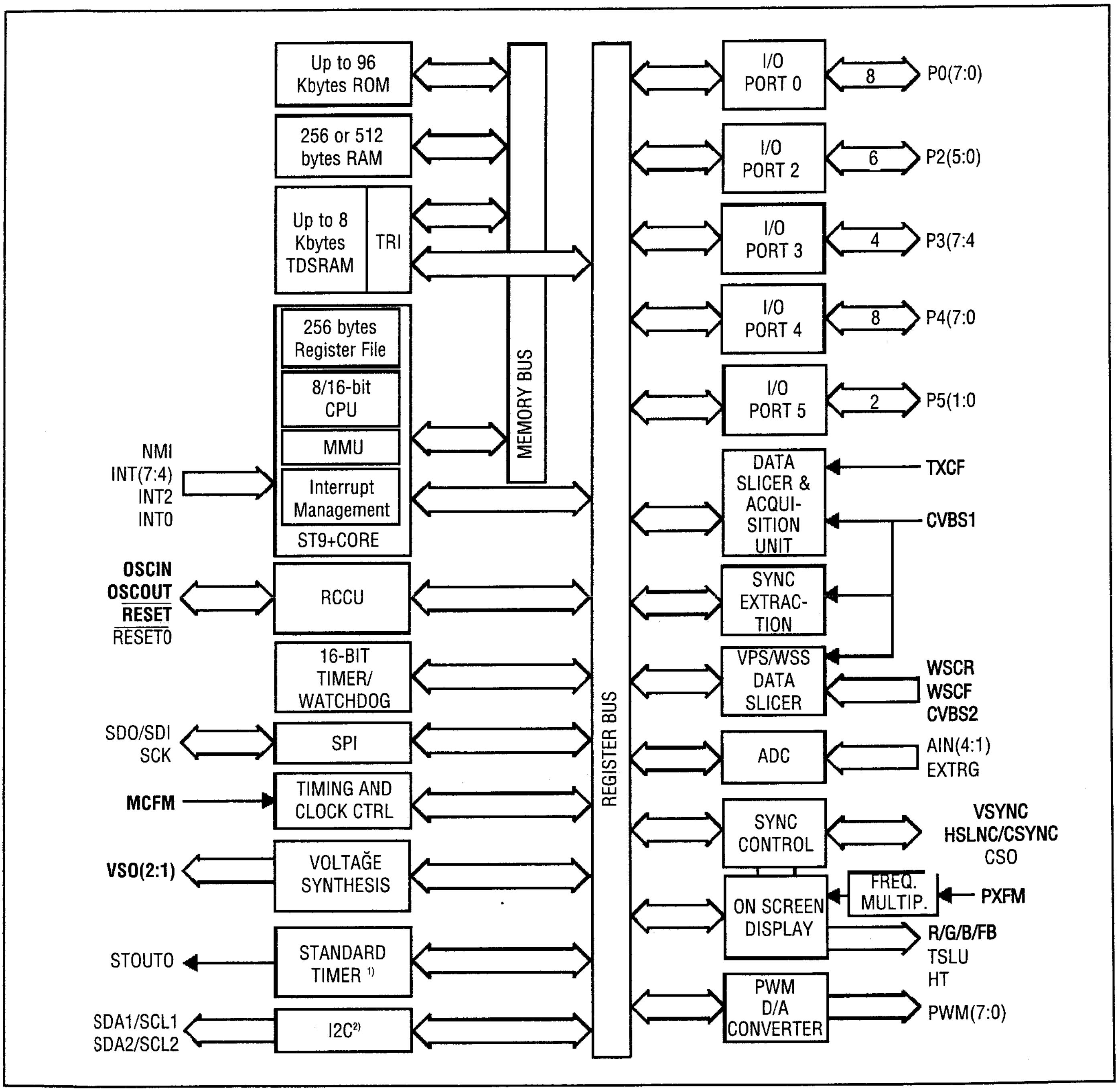
- Voltage Synthesis
- VPS / WSS Slicer
- Teletext Slicer
- Teletext Display RAM
- OSD

Pig. ST921x5 Microcontroller Block diagram

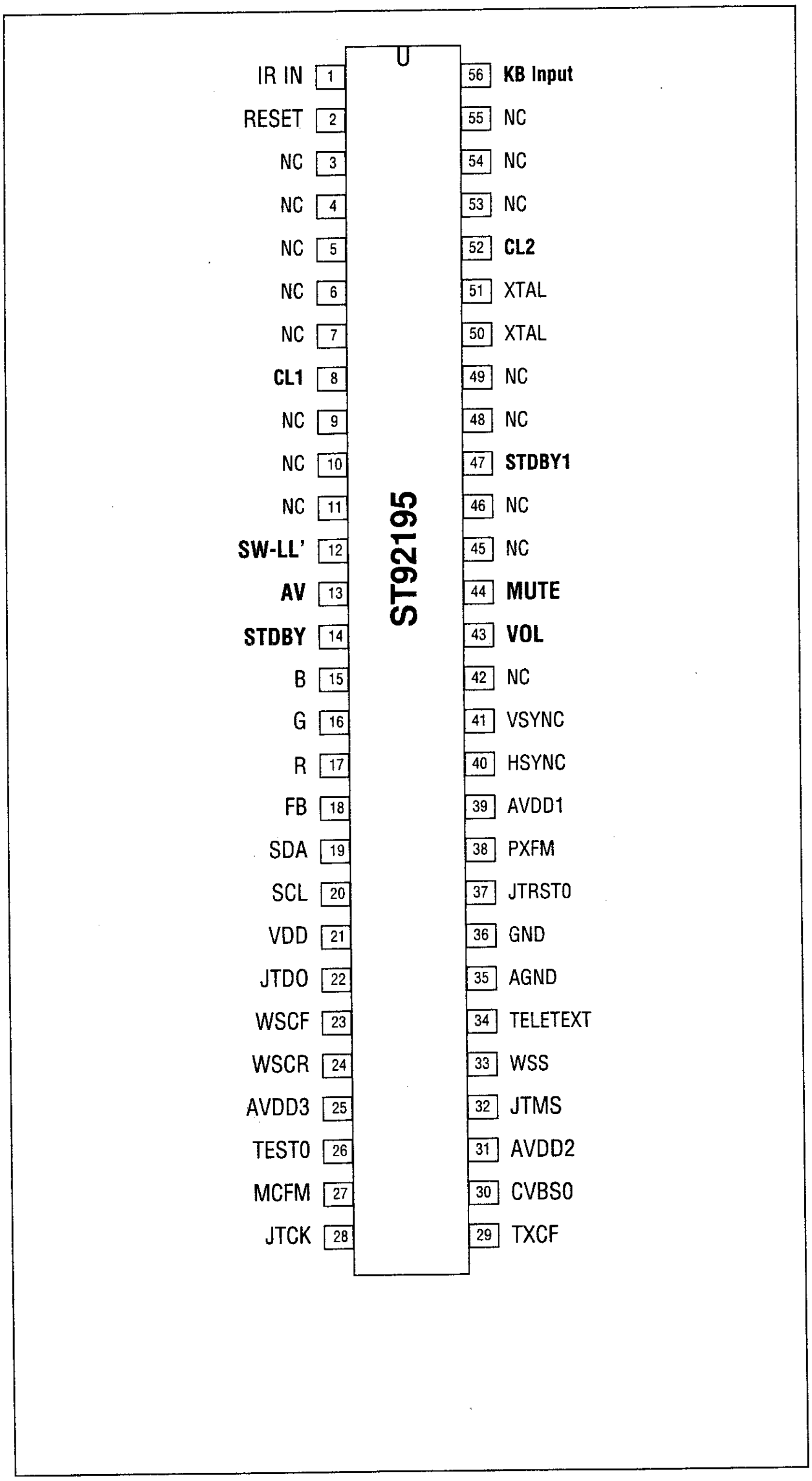
GENERAL FEATURES

- Register File based 8/16 bit Core Architedure with RUN, WFI, SLOW and HALT modes
- 0°C to +700C Operating Temperature Range available
- Up to 24 MHz Operation @ 5V±10%
- Minimum instruction cycle time: 375nS at 16MHz internal clock
- 64K Bytes ROM
- 256 Bytes RAM of Register file (accumulators or index registers)
- 256 Bytes of on-chip static RAM
- 8K Bytes of TDSRAM (Teletext and Display RAM)
- 56-lead Shrink DIP package
- 28 fully programmable I/O pins
- Serial Peripheral Interface
- Flexible Clock controller for OSD, Data Slicer and Core clocks running from one single low frequency external crystal.
- Enhanced Display Controller with 26 rows of 40/80 characters
- Serial and Parallel attributes
- 10x10 dot Matrix, 512 ROM characters, definable by user
- 4/3 and 16/9 supported
- Rounding, fringe, double width, double height, scrolling, cursor, full background colour, semi-transparent mode and reduced intensity colour supported Teletext unit, including Data slicer, Acquisition Unit and up to 8K Bytes
- RAM for Data Storage
- VPS and Wide Screen Signalling slicer
- Integrated Sync Extractor and Sync Controller
- 14-bit Voltage Synthesis for tuning reference voltage
- Up to 6 External Interrupts plus 1 non-maskable interrupt
- 8 x 8-bit programmable PWM outputs with 5V open-drain or push-pull
- Capability
- 16-bit Watchdog timer with 8-bit prescaler
- 16-bit standard timer with 8-bit prescaler usable as a Watchdog timer
- 3-channel Analog-to-Digital converter; 6-bit guaranteed
- Rich instruction set and 14-Addressing modes

Block Diagram


Up to 96 Kbytes ROM
256 or 512 bytes RAM
Up to 8 Kbytes TDSRAM
TRI
256 bytes Register File
8/16-bit CPU
MMU
Interrupt Management
ST9+CORE
MEMORY BUS
REGISTER BUS
NMI
INT(7:4)
INT2
INT0
OSCIN
OSCOUT
RESET
RESETO
RCCU
16-BIT TIMER/ WATCHDOG
SDO/SDI
SCK
SPI
MCFM
TIMING AND CLOCK CTRL
VSO(2:1)
VOLTAGE SYNTHESIS
STOUTO
STANDARD TIMER 1)
SDA1/SCL1
SDA2/SCL2
I2C 2)
I/O PORT 0
8
P0(7:0)
I/O PORT 2
6
P2(5:0)
I/O PORT 3
4
P3(7:4
I/O PORT 4
8
P4(7:0
I/O PORT 5
2
P5(1:0
DATA SLICER & ACQUI-SITION UNIT
TXCF
CVBS1
SYNC EXTRAC-TION
VPS/WSS DATA SLICER
WSCR
WSCF
CVBS2
ADC
AIN(4:1)
EXTRG
SYNC CONTROL
VSYNC
HSLNC/CSYNC
CSO
ON SCREEN DISPLAY
FREQ. MULTIP.
PXFM
R/G/B/FB
TSLU
HT
PWM D/A CONVERTER
PWM(7:0)

4- Pin description


ST92195
IR IN 1
RESET 2
NC 3
NC 4
NC 5
NC 6
NC 7
CL1 8
NC 9
NC 10
NC 11
SW-LL' 12
AV 13
STDBY 14
B 15
G 16
R 17
FB 18
SDA 19
SCL 20
VDD 21
JTDO 22
WSCF 23
WSCR 24
AVDD3 25
TESTO 26
MCFM 27
JTCK 28
29 TXCF
30 CVBSO
31 AVDD2
32 JTMS
33 WSS
34 TELETEXT
35 AGND
36 GND
37 JTRSTO
38 PXFM
39 AVDD1
40 HSYNC
41 VSYNC
42 NC
43 VOL
44 MUTE
45 NC
46 NC
47 STDBY1
48 NC
49 NC
50 XTAL
51 XTAL
52 CL2
53 NC
54 NC
55 NC
56 KB Input

PINNING

Pin	Symbol	Function
1	P2.0IRIN	IIR Input
2	RESETRESETI	Hardware Reset
3	P0.7NCI/0	Not Used
4	P0.6NCI/0	Not Used
5	P0.5NCI/0	Not Used
6	P0.4NCI0	Not Used
7	P0.3NCI	Not Used
8	P0.2CL1I	SCART 1 status input
9	P0.1NCI/0	Not Used
10	P0.0NCI/0	Not Used
11	P3.7NCI/0	Not Used
12	P3.6SW-LL'0SAW	Filter Switch for L/L'
13	P3.5AV0	Sound switch for two AV source in mono chassis
14	P3.4STDBY0	Standby ON/OFF
15	BB00SD	Blue colour Signal Output
16	GG00SD	Green colour Signal Output
17	RR00SD	Red colour Signal Output
18	BLANKBLANK00SD	Blanking Output
19	P5.1SDAI/0I2C	Data Line
20	P5.0SCL0I2C	Clock line
21	VDDVDD	+5V Digital Supply
22	JTD0JTD0	Test Pin
23	WSCFWSCF	Analog Pin For VPS /WPP slicer line PLL
24	WSCRWSCR	Analog Pin For VPS /WPP slicer line PLL
25	AVDD3AVDD3	+5V Analog VDD For PLL
26	TEST0TEST0	Test pin
27	MCFBMCFB	Analog Pin for VPS/ WSS line PLL
28	JTCKJTCK	Test pin
29	TXCFTXCF	Analog Pin for VPS/ WSS line PLL
30	CVBS0CVBS0	Test pin
31	AVDD2AVDD2	Analog Power Supply
32	JTMSJTMS	Test pin
33	CVBS2CVBS2ICVBS	In for VPS/WSS
34	CVBS1CVBS1ICVBS	In for Teletext Slicer
35	AGNDAGND	Analog Ground
36	GNDGND	Digital Ground
37	JTRST0JTRST0	Test pin
38	PXFMPXFM	Analog pin for display pixel freq. multiplier
39	AVDD1AVDD1	Analog Power Supply
40	HSYNCHSYNCI	Horizontal Sync Input

PINNING

Pin	Symbol	Function
41	VSYNCVSYNCI	Vertical Sync Input
42	P4.0NCI/0	Band Switch 1
43	P4.1VOLOPWM	Gain Control for Audio amp.
44	P4.2MUTE0	Mute output pin
45	P4.3NCI/0	Not Connected
46	P4.4NCI/0	Not Connected
47	P4.5STDBY10	Eco Switch Control
48	P4.6NCI/0	Not Connected
49	P4.7NCI/0	Not Connected
50	XTALXTAL	Clock Oscillator
51	XTALXTAL	Clock Oscillator
52	P2.5CL2ISCART2	Status Input
53	P2.4NCI/OLED	Output Pin
54	P2.3NCI/0	Not Connected
55	P2.2NCI/0	Not Connected
56	P2.1KBInputI	Key Board Input

RESET

Reset input is an active-low one. ST921x5 is initialized by the RESET signal.

When the RESET deactivated, programme execution starts from the 00H and 01H addressed programme memory locations.

R/G/B/BLANK

The video colour analogue DAC outputs are Red / Green / Blue / Fast Blanking.

XTAL

These pins are used to connect parallel resonant crystals of 4 MHz

AV Status

Logic Level Control (High or Low)

Pin 8 and Pin 52 monitor the status of the AV SCART connectors. The controller detects the transitions at these pins. When the signal goes from high to low, the TV set will automatically switch to AV mode. The signal going from low to high will lead the TV set to go back to the previous source. Voltage Level Control (0...12V)

Voltage measurement values are taken from these pins. 4:3 or 16:9 picture ratio from SCART or TV mode selection is dependent on the voltage values at these pins. User control always has a priority in both TV and

AV mode. Following the change of source or the channel, 4:3 format is assumed by default. The voltage values stated below are divided by 3 at the microcontroller pins.

AV Status (Pin 8)Picture Ratio

- 0 - 2.0 VTV Mode
- 2.0 - 4.5V No change
- 4.5 - 7.0V 16:9 Scart
- 7.0 - 9.0V No change
- 9.0 - 12.0V 4:3 Scart

Keyboard Scan Lines

The 4 keys of the local keyboard are scanned by an ADC used by the microcontroller.

Table Local Keyboard

Name CodeTV ModeTXT Sub mode

- Volume Down0Volume -Volume -
- Volume Up1Volume +Volume +
- Programme Down2Programme -Page -
- Programme Down3Programme +Page +

Power Mode Control

The STDBY (pin 14) output specifies the mode which the set is in; Stand-by mode or Operating mode.

Table Power Modes:

ST-BYMode

- 1-Stand-by
- 0-Operating

I^2C Lines

Pin 20 (SCL) and Pin 19 (SDA) accept inputs from the I^2C bus. I^2C is a 2-wire bi-directional bus. PT90A has an on-chip bit-level I^2C interface. This means the bus arbitration, the reception and transmission of data bits and the generation of START and STOP are manipulated by the hardware. The software must be able to handle these bits (i.e. save a received bit and prepare the bits to be transmitted). If a transmission does not succeed, the software will retry for 5 times. If the bus is occupied for more than 1.18 ms. the microcontroller will attempt to free the bus. PT90A supports a 1K EEPROM (M24C08-BN6), used for storage of analogue controls, tuning data for 100 pre-selected programmes and options. The I^2C addresses of the EEPROM is described in the following chapters. Furthermore the video-processor STV224x is controlled via I^2C bus on address 8AH.

24C08
Non-Volatile Memory

These I²C-compatible electrically erasable programmable memory (EEPROM) is organized as 1024 x 8 bit and operate with a power supply of 5 V. The memory behaves as a slave device in the I²C protocol, with all memory operations synchronized by the serial clock. Read and Write operations are initiated by a START condition, generated by the bus master. The START condition is followed by a Device Select Code and RW bit terminated by an acknowledg bit.

Table 6. DC Characteristics

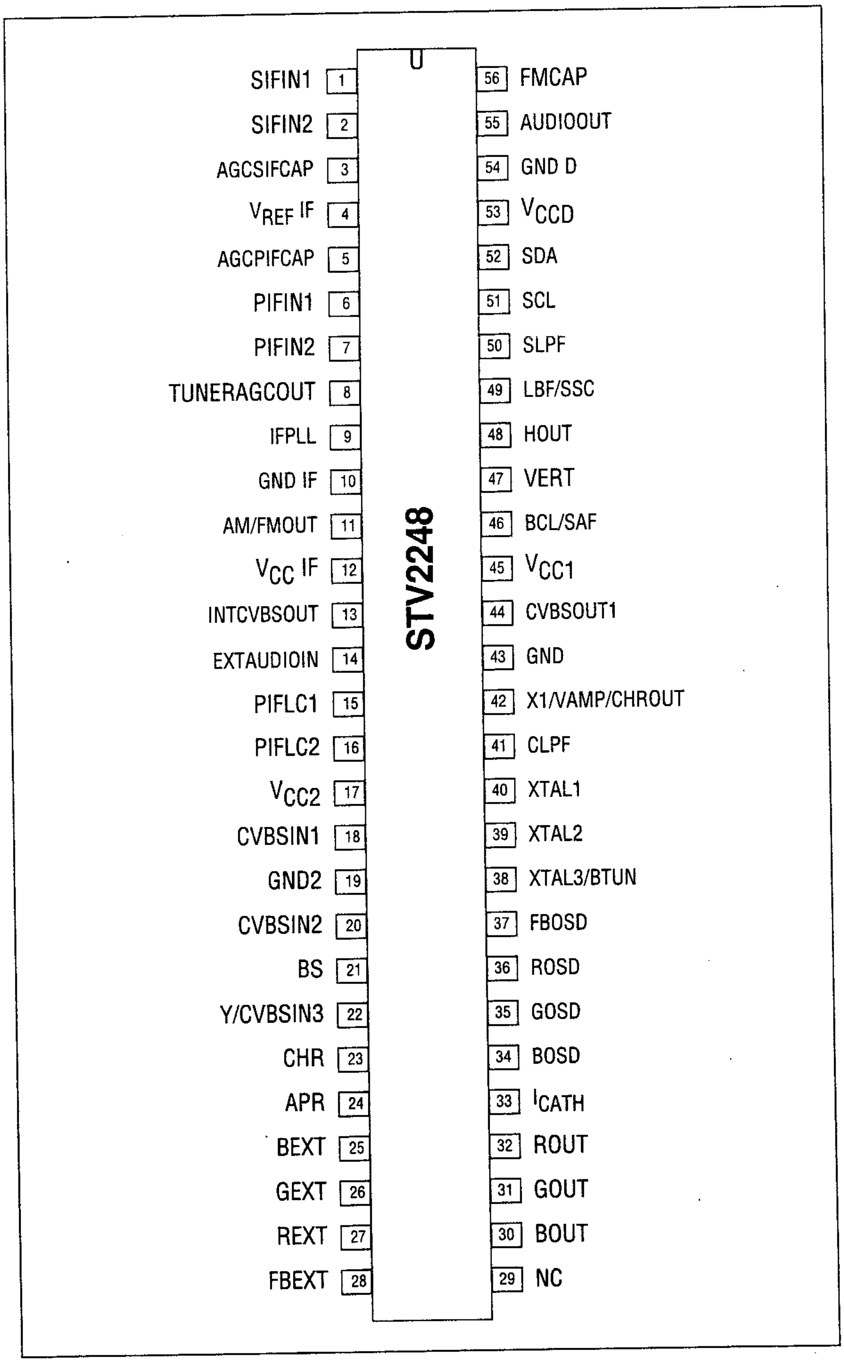
(T_A= 0 to 70°C, -20 to 85°C or - 40 to 85°C; Vcc = 3V to 5.5V, 2.5V to 5.5V or 1.8V to 5.5V)

Symbol	Parameter	Test Condition	Min.	Max.	Unit
I_{LI}	Input Leakage Current	$0V \leq V_{IN} \leq V_{CC}$	-	±2	µA
I_{LO}	Output Leakage Current	$0V \leq V_{OUT} \leq V_{CC}$ SDA in Hi-Z	-	±2	µA
I_{CC}	Supply Current (ST24 series)	V_{CC} = 5V, fc= 100kHz (Rise/Fall time < 10ns)		2	mA
	Supply Current (ST25 series)	V_{CC} = 2.5V, fc= 100kHz		1	mA
I_{CC1}	Supply Current (Standby) (ST24 series)	$V_{IN} = V_{SS}$ or V_{CC} VCC = 5V		100	µA
		$V_{IN} = V_{SS}$ or V_{CC} V_{CC} = 5V, fc= 100kHz		300	µA
I_{CC2}	Supply Current (Standby) (ST25 series)	$V_{IN} = V_{SS}$ or V_{CC} VCC = 2.5V		5	µA
		$V_{IN} = V_{SS}$ or V_{CC} V_{CC} = 2.5V, fc= 100kHz		50	µA
I_{CC3}	Supply Current (Standby) (ST24C08R)	$V_{IN} = V_{SS}$ or V_{CC} VCC = 3.6V		20	µA
		$V_{IN} = V_{SS}$ or V_{CC} V_{CC} = 3.6V, fc= 100kHz		60	µA
I_{CC4}	Supply Current (Standby) (ST24C08R)	$V_{IN} = V_{SS}$ or V_{CC} VCC = 1.8V		10	µA
		$V_{IN} = V_{SS}$ or V_{CC} V_{CC} =1.8V, fc= 100kHz		20	µA
V_{IL}	Input Low Woltage (SCL, SDA)		-0.3	$0.3V_{CC}$	V
V_{IH}	Input High Woltage (SCL, SDA)		$-0.7V_{CC}$	V_{CC} +1	V
V_{IL}	Input Low Woltage (E,PRE,MODE,$\overline{WC}$)		-0.3	0.5	V
V_{IH}	Input High Woltage (E,PRE,MODE,$\overline{WC}$)		V_{CC}-0.5	V_{CC} +1	V
VOL	Output Low Voltage (ST24 series)	I_{CL} = 3mA, V_{CC} = 5V		0.4	V
	Output Low Voltage (ST25 series)	I_{CL} = 2.1mA, V_{CC} = 2.5V		0.4	V
	Output Low Voltage (ST24C08 series)	I_{CL} = 1mA, V_{CC} = 1.8V		0.3	V

STV224X
Multistandard TV Processor

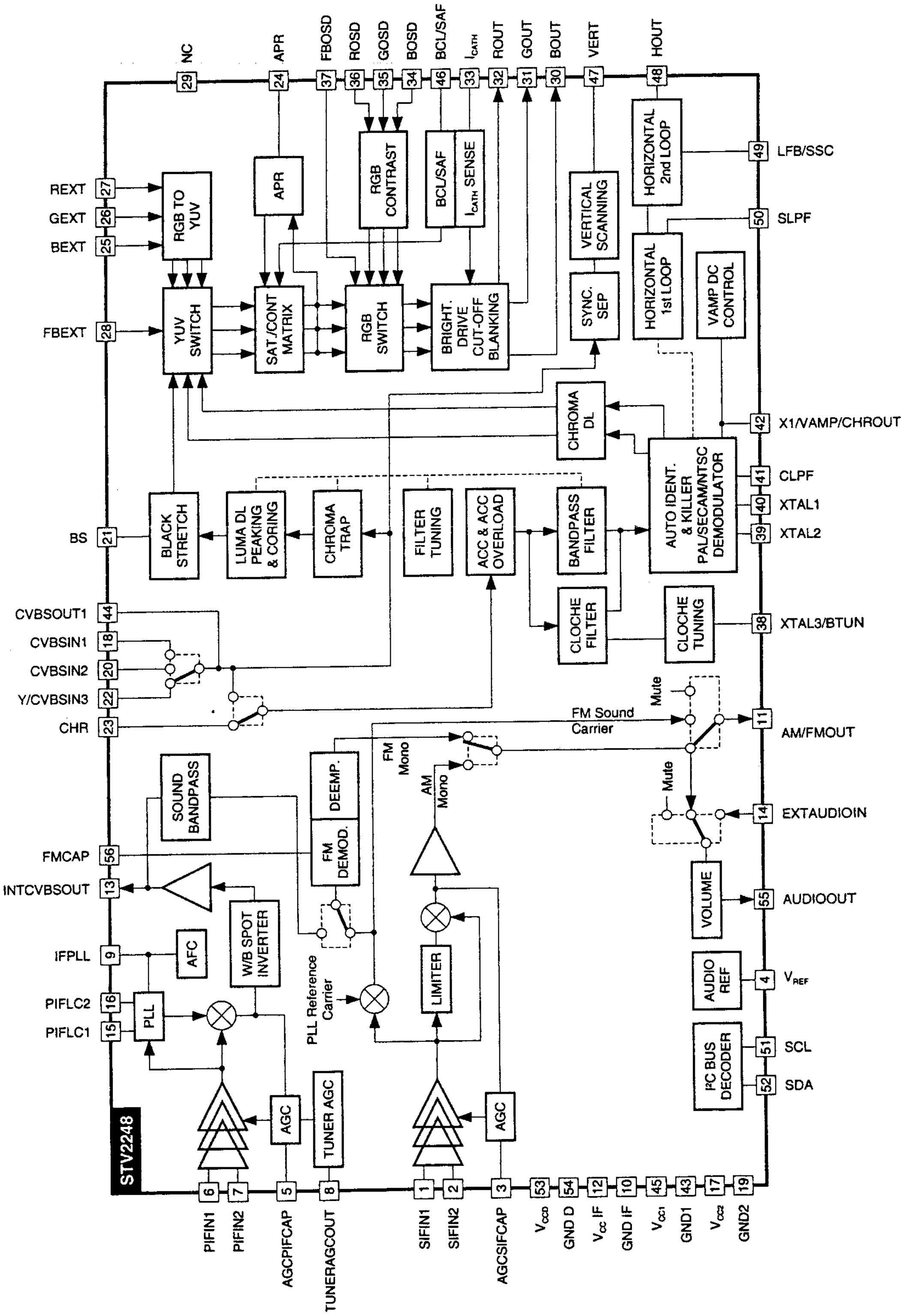
STV224X is a fully bus controlled IC for n/ including PIF, SIF, Luminance, Chrominance and deflection processing. It is a bus controlled PAL / SECAM / NTSC single chip TV Processor. For details of STV224X features please refer to the STV224X datasheet. 110°, 4:3 or 16:9 CRT application. It integrates both vertical deflection and E-W correction circuit necessary for design of 110° chassis it allows designing a PAL / NTSC (BGDKIMN) set with very few external componentsand no manual adjustment.

Pin connections


SIFIN1 1
SIFIN2 2
AGCSIFCAP 3
VREF IF 4
AGCPIFCAP 5
PIFIN1 6
PIFIN2 7
TUNERAGCOUT 8
IFPLL 9
GND IF 10
AM/FMOUT 11
VCC IF 12
INTCVBSOUT 13
EXTAUDIOIN 14
PIFLC1 15
PIFLC2 16
VCC2 17
CVBSIN1 18
GND2 19
CVBSIN2 20
BS 21
Y/CVBSIN3 22
CHR 23
APR 24
BEXT 25
GEXT 26
REXT 27
FBEXT 28
STV2248
56 FMCAP
55 AUDIOOUT
54 GND D
53 VCCD
52 SDA
51 SCL
50 SLPF
49 LBF/SSC
48 HOUT
47 VERT
46 BCL/SAF
45 VCC1
44 CVBSOUT1
43 GND
42 X1/VAMP/CHROUT
41 CLPF
40 XTAL1
39 XTAL2
38 XTAL3/BTUN
37 FBOSD
36 ROSD
35 GOSD
34 BOSD
33 ICATH
32 ROUT
31 GOUT
30 BOUT
29 NC

Pin	Symbol	Function
1	SIFIN1	SIF Input
2	SIFIN2	SIF Input
3	AGCSIFCAP	AGC SIF Capacitor
4	VREF IF	Voltage Reference Filtering
5	AGCPIFCAP	AGC PIF Capacitor
6	PIFIN1	PIF Input
7	PIFIN2	PIF Input
8	TUNERAGCOUT	AGC Tuner Output
9	IFPLL	IF PLL Filter
10	GND IF	IF Ground
11	AM/FMOUT	AM/FM Mono Sound or Stereo Carriers Output
12	V_{CC} IF	5V IF Supply
13	INTCVBSOUT	Internal CVBS Output
14	EXTAUDIOIN	Audio scart Input
15	PIFLC1	LC Input
16	PIFLC2	LC Input
17	V_{CC2}	Video/Luma Supply Voltage (8V)
18	CVBSIN1	Internal Video Input
19	GND2	Video/luma Ground
20	CVBSIN2	External Video Input
21	BS	Black Stretch Capacitor
22	Y/CVBSIN3	Y(SVHS) or CVBS3 External Input
23	CHR	Chroma (SVHS) input
29	APR	Auto Peak Regulation
25	BEXT	External Blue Input
26	GEXT	External Green Input
27	REXT	External Red Input
28	FBEXT	External Fast Blanking Input
29	NC	Not to be connected
30	BOUT	Blue Output
31	GOUT	Green Output
32	ROUT	Red Output
33	I_{CATH}	Cathode Current Measurement Input
34	BOSD	OSD Blue Input
35	GOSD	OSD Green Input
36	ROSD	OSD Red Input
37	FBOSD	OSD Fast Blanking
38	XTAL3/BTUN	3.5XMHz Crystal or Cloche Filter Tuning Capacitor
39	XTAL2	3.5XMHz Crystal
40	XTAL 1	4.43/3.5XMHz Crystal
41	CLPF	Chroma PLL Filter
42	X1/VAM/CHROUT	XTAL1 Control Pin Vertical Amplitude DAC Output and Chroma Reference Signal Output
43	GND 1	Chroma/Scanning Ground
44	CVBSOUT 1	Main Video Switch Output
45	V_{CC1}	Chroma/Scanning Power Supply (8V)
46	BCL/SAF	Beam Current Limiter Control Voltage and Safety input (XRAY)
47	VERT	Vertical Output Pulse
48	HOUT	Horizontal Output Pulse
49	LFB/SSC	Line Flyback Input and Super-sandcastle Output
50	SLPF	Scanning PLL Filter
51	SCL	I^{2}C Bus Clock Input
52	SDA	I^{2}C Bus Data Input
53	V_{CCD}	Digital Supply Voltage (5V)
54	GND D	Digital Ground
55	AUDIOOUT	Main Audio Output
56	FMCAP	FM Demodulation Capacitor

Block Diagram


NC
APR
FBOSD
ROSD
GOSD
BOSD
BCL/SAF
I_{CATH}
ROUT
GOUT
BOUT
VERT
HOUT
29
24
37
36
35
34
46
33
32
31
30
47
48
REXT
GEXT
BEXT
27
26
25
RGB TO YUV
APR
RGB CONTRAST
BCL/SAF
I_{CATH} SENSE
VERTICAL SCANNING
HORIZONTAL 2nd LOOP
49
LFB/SSC
50
SLPF
FBEXT
28
YUV SWITCH
SAT./CONT MATRIX
RGB SWITCH
BRIGHT. DRIVE CUT-OFF BLANKING
SYNC. SEP
HORIZONTAL 1st LOOP
VAMP DC CONTROL
CHROMA DL
42
X1/VAMP/CHROUT
AUTO IDENT. & KILLER PAL/SECAM/NTSC DEMODULATOR
41
CLPF
40
XTAL1
39
XTAL2
BS
21
BLACK STRETCH
LUMA DL PEAKING & CORING
CHROMA TRAP
FILTER TUNING
ACC & ACC OVERLOAD
BANDPASS FILTER
CVBSOUT1
44
CVBSIN1
18
CVBSIN2
20
Y/CVBSIN3
22
CHR
23
CLOCHE FILTER
CLOCHE TUNING
38
XTAL3/BTUN
Mute
FM Sound Carrier
11
AM/FMOUT
FM Mono
AM Mono
SOUND BANDPASS
DEEMP.
FM DEMOD.
Mute
14
EXTAUDIOIN
FMCAP
56
INTCVBSOUT
13
VOLUME
55
AUDIOOUT
W/B SPOT INVERTER
LIMITER
IFPLL
9
AFC
AUDIO REF
4
V_{REF}
PLL Reference Carrier
PIFLC2
16
PIFLC1
15
PLL
I^2C BUS DECODER
51
SCL
52
SDA
STV2248
AGC
TUNER AGC
AGC
6
7
5
8
1
2
3
53
54
12
10
45
43
17
19
PIFIN1
PIFIN2
AGCPIFCAP
TUNERAGCOUT
SIFIN1
SIFIN2
AGCSIFCAP
V_{CCD}
GND D
V_{CC} IF
GND IF
V_{CC1}
GND1
V_{CC2}
GND2

MAIN FEATURES

- I²C bus control (readl and write modes),
- PIF PLL demodulator, Bus controlled VCO alignment,
- IF positive and negative modulation,
- Digital AFC,
- Tuner delayed AGC output,
- White and Black spot cancellation,
- SIF with QSS or intercarrier structure,
- Built in sound bandpass,
- Multistandard PLL FM demodulator (4.5, 5.5, 6.0,6.5MHz),
- AM demodulator for France,
- FM sound carriers output for Stereo chassis,
- Audio switch for external audio input, Mono chassis,
- Digital volume control,
- Audio Mute,
- Video switch, 3 CVBS inputs, 1 CVBS output which can be used to drive teletext decoder,
- SVHS switch, Y input is combined with CVBS3 input,
- OSD RGB analog inputs, fast blanking detection on OSD fast blanking pin, contrast control capability, oversize blanking capability on OSD fast blanking input,
- External analog RGB inputs with contrast and saturation control (external RGB matrixed in YUV).
- Integrated chroma filters (trap, bandpass, cloche) with automatic alignment,
- Integrated luminance delay line,
- Adjustable peaking on the luminance signal with coring function,
- Black strech circuit,
- PAL / SECAM / NTSC color decoder with automatic identification of standards,
- Integrated chroma delay line,
- Full integrated SECAM decoder,
- Hue control, two selectable matrixes in NTSC mode,
- Automatic flesh control circuit with two selectable characteristics (normal and wide),
- ACC overload circuit,
- Chroma subcarrier output which could be used to drive comb filter circuit,
- Automatic RGB peak regulation (APR).
- Automatic digital cut-off current loop with warm-up detection circuit,
- White point and cut-off point adjustments,
- Beam current limiter control stage,
- High performance synchronization pulses separator,
- Horizontal synchronization with two phase locked loops,
- Integrated VCO, auto-calibration using the chroma crystal reference frequency,
- Automatic time constant selection for the first PLL, 3 selectable time contants,
- Video identification circuit (independant from PLL1),
- Noise detector circuity
- Vertical countdown circuit,
- Automatic 50/60Hz selection circuit,
- Blanking and inserted cut-off pulses position adapted to standard (50 or 60Hz),
- Long blanking mode capability in 60Hz (same blanking as 50Hz standard),
- Possibility to insert cut-off pulses after a vertical oversize blanking signal,
- De-interlace capability,
- Horizontal starting circuit with soft-start capability,
- Horizontal and vertical position adjustments, vertical amplitude control voltage (combined with chroma subcarrier output),
- 4/3, 16/9 selection voltage.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC} 8V	8V supply voltage	10	V
V_{CC} 5V	5V supply voltage	7	V
VESD	Capacitor 100pF discharged via 1.5kΩ serial resistance (Human Body Model)	±2	kV
Toper	Operating Temperature	0,+70	°C
Tstg	Storage Temperature	-55 +150	°C

THERMAL DATA

Symbol	Parameter	Typical Value	Unit
Rth(j-a)	Junction ambient Thermal Resistance (Measured at P_D= 1W) SDIP56	40	°C/W

ELECTRICAL CHARACTERISTICS

Supplies at Typical Values, Tamb =25 °C, I^2C bus register at power-on reset value. unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
SUPPLY						
V_{CCIF}	IF Circuit Supply Voltage		4.75	5	5.25	V
V_{CCD}	Bus & Digital Supply Voltage		4.75	5	5.25	V
V_{CC1}	Chroma, Scanning Supply Voltage		7.6	8	8.4	V
V_{CC2}	Video Supply Voltage		7.6	8	8.4	V
I_{CCF}	V_{CCIF} Current Consumtion	V_{CCIF} = 5V		TBD		mA
I_{CC5V}	V_{CC5V} Current Consumtion	V_{CCD} = 5V		TBD		mA
I_{CC1}	V_{CC1} Current Consumtion	V_{CC1} = 8V		TBD		mA
I_{CC2}	V_{CC2} Current Consumtion	V_{CC2} = 8V		TBD		mA
P_D	Total Power Dissipation	V_{CC1} = V_{CC2} =8V, V_{CCIF} = V_{CC5V} = 5V		TBD		mW

MSP34XX (D/G)
Multistandard Sound Processor

The MSP34xx (D/G) family of single-chip Multistandard Sound Processors covers the sound processing of all analog TV-Standards worldwide, as well as the NICAM digital sound standards. The full TV sound processing, starting with analog sound IF signal-in, down to processed analog AF-out, is performed on a single chip. It covers all European TV-Standards The MSP 3400 1.0 m CMOS version is fully pin and soft-ware compatible to the MSP 3410, but is not able to de-code NICAM. It is also compatible to the MSP 3400C 0.8 m CMOS version.

The IC is produced in submicron CMOS technology, combined with high performance digital signal processing.

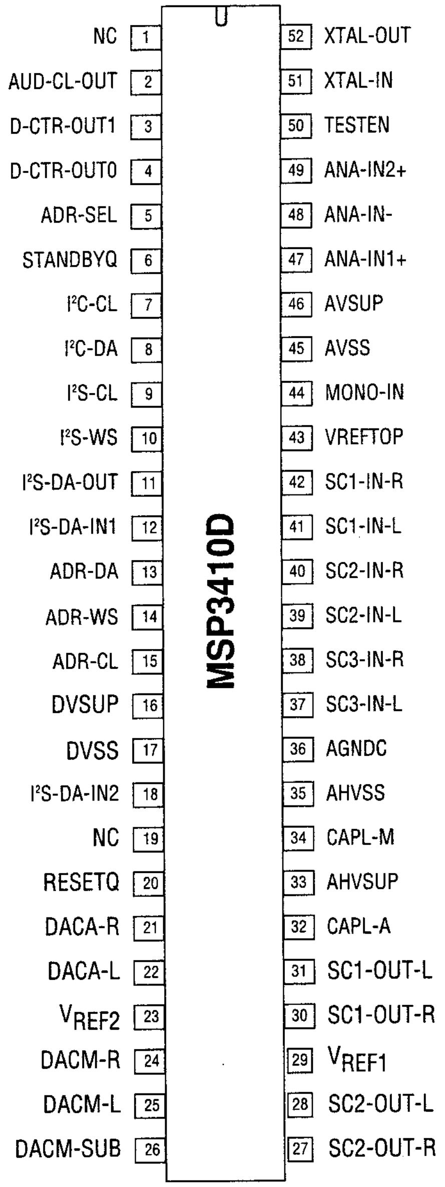
The MSP 3410D is available in a PLCC68, PSDIP64, PSDIP52, and in a PQFP80 package.

Note: The MSP3410D version is fully downward compatible to the MSP 3410B, the MSP 3400B, and the MSP3400C. To achieve full software compatibility with MSP3400C, MSP 3400B, and MSP 3410B, the demodulator part must be programmed as described in the data sheet of MSP 3410B.

MSP 3410D Additional Features

- AVC: Automatic Volume Correction
- Subwoofer Output
- 5-band graphic equalizer (as in MSP 3400C)
- Enhanced spatial effect (pseudostereo/basewidth en-largement as in MSP 3400C)
- Headphone channel with balance, bass, treble, loud-ness
- Balance for loudspeaker and headphone channels in dB units (optional)
- Additional parr of D/A converters for SCART2 out
- Improved oversampling filters (as In MSP 3400C)
- Additional SCART input
- Full SCART In/out matrix without restrictions
- Scart volume in dB units (optional)
- Additional I2S input (as in MSP 3400C)
- New FM-identification (as in MSP 3400C)
- Demodulator- short programming
- Autodetection for- terrestrial TV-sound standards
- Precise bit-error rate indication
- Automatic switching from NICAM to FM/AM or vice versa
- Improved NICAM synchronization algorithm
- Tmproved carrier mute algorithm
- Improved AM-demodulation
- ADR together- with DRP 3510A
- Dolby Pro Logic together with DPL 35xx A
- Reduction of necessary controlling
- Less external components
- Significant reduction of radiation

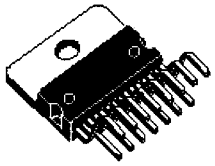
Pin description


MSP3410D
NC 1
AUD-CL-OUT 2
D-CTR-OUT1 3
D-CTR-OUT0 4
ADR-SEL 5
STANDBYQ 6
I^{2}C-CL 7
I^{2}C-DA 8
I^{2}S-CL 9
I^{2}S-WS 10
I^{2}S-DA-OUT 11
I^{2}S-DA-IN1 12
ADR-DA 13
ADR-WS 14
ADR-CL 15
DVSUP 16
DVSS 17
I^{2}S-DA-IN2 18
NC 19
RESETQ 20
DACA-R 21
DACA-L 22
V$_{REF2}$ 23
DACM-R 24
DACM-L 25
DACM-SUB 26
52 XTAL-OUT
51 XTAL-IN
50 TESTEN
49 ANA-IN2+
48 ANA-IN-
47 ANA-IN1+
46 AVSUP
45 AVSS
44 MONO-IN
43 VREFTOP
42 SC1-IN-R
41 SC1-IN-L
40 SC2-IN-R
39 SC2-IN-L
38 SC3-IN-R
37 SC3-IN-L
36 AGNDC
35 AHVSS
34 CAPL-M
33 AHVSUP
32 CAPL-A
31 SC1-OUT-L
30 SC1-OUT-R
29 V$_{REF1}$
28 SC2-OUT-L
27 SC2-OUT-R

TDA7495

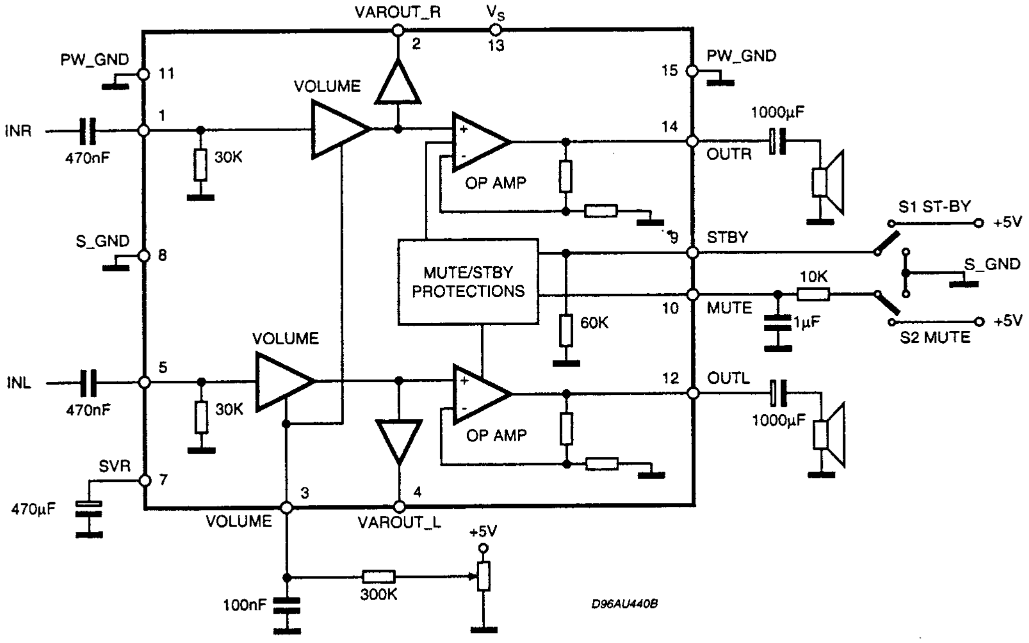
11+11W Amplifier With DC Volume Control

- 11+11W Output Power
- RL = 8Ω @THD = 10% VCC = 28V
- ST-BY and mute functions
- Low turn-on turn-off pop noise
- Linear volume control DC coupled
- With Power Op. Amp.
- No Boucherot Cell
- No ST-BY RC input network
- Single supply ranging up to 35V
- Short circuit protection
- Thermal Overload protection
- Internally fixed gain
- Soft Clipping
- Variable output after volume control
- Circuit multiwatt 15 package



Multiwatt 15
ORDERING NUMBER: TDA7495

Block and Application Diagram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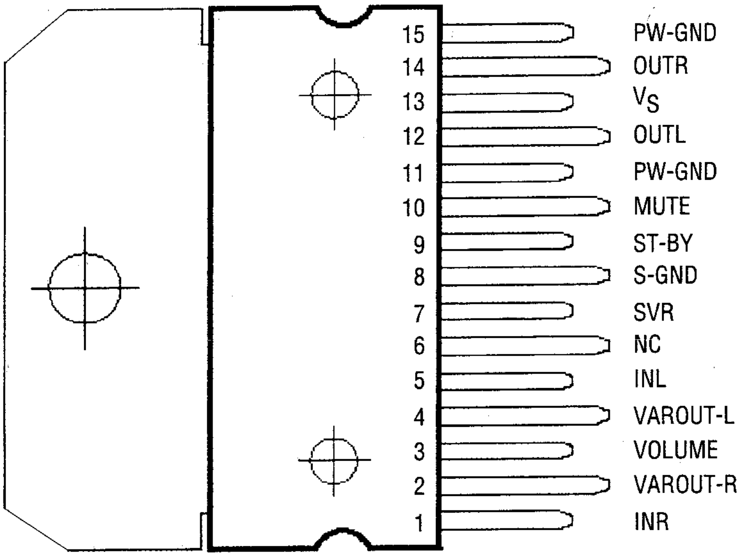
VS
2
13
PW_GND
11
15
PW_GND
VOLUME
INR
1
14
1000µF
470nF
30K
OUTR
OP AMP
S1 ST-BY
+5V
S_GND
9
STBY
8
MUTE/STBY
PROTECTIONS
S_GND
10K
10
MUTE
60K
1µF
+5V
S2 MUTE
VOLUME
INL
5
12
OUTL
470nF
30K
OP AMP
1000µF
SVR
7
470µF
3
4
VOLUME
VAROUT_L
+5V
100nF
300K
D96AU440B

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	DC Supply Voltage	35	V
V_{IN}	Maximum Input Voltage	8	Vpp
P_{tot}	Total Power Dissipation (Tamb = 70 °C)	20	W
Tamb	Ambient Operating Temperature (1)	-20 to 85	°C
Tstg, Tj	Storage and Junction Temperature	-40 to 150	°C
V_3	Volume CTRL DC voltage	7	V

(1) Operation between -20 to 85 °C guaranteed by correlation with 0 to 70 °C

PIN CONNECTION (Top view)



THERMAL DATA

Symbol	Parameter	Value	Unit
Rth j-case	Thermal Resistance Junction - case	Typ. = 2 Max. = 2.8	°C/W
Rth j-amb	Thermal Resistance Junction - ambient max.	35	°C/W

ELECTRICAL CHARACTERISTICS

(Refer to the test circuit $V_S = 20V$ $R_L = 8\Omega$, $R_g = 50\Omega$, $T_{amb} = 25°C$

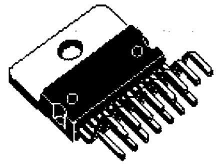
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_S	Supply Voltage Range		11		35	V
I_q	Total Quiescent Current			70	100	mA
DCV_{OS}	Output DC Offset Referred to SVR Potential	No Input Signal	-650		650	mV
V_0	Quiescent Output Voltage			10		V
P_0	Output Power	THD = 10%; $R_L = 8\Omega$; $V_S = 28V$	9.5	11		W
		THD = 1%; $R_L = 8\Omega$; $V_S = 28V$	7.5	8		W
		THD = 10%; $R_L = 4\Omega$; $V_{CC} = 20V$	7	8		W
		THD = 1%; $R_L = 4\Omega$; $V_{CC} = 20V$	5	6		W
		THD = 10%; $R_L = 8\Omega$; $V_{CC} = 18V$	3.5	3.8		W
		THD = 1%; $R_L = 8\Omega$; $V_{CC} = 18V$	2.6	2.9		W

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
THD	Total Harmonic Distortion	Gv=30dB; Po=1W; f=1KHz			0.4	%
Ipeak	Output Peak Current	(internally limited)	1.7	2.4		A
Vin	Input Signal				2.8	Vrms
Gv	Closed Loop Gain	Vol Ctrl > 4.5V	28.5	30	31.5	dB
GvLine	Monitor Out Gain	Vol Ctrl > 4.5V; Zload > 30KΩ	-1.5	0	1.5	dB
A_{Min} Vol	Attenuation at Minimum Volume	Vol Ctrl < 0.5V	80			dB
BW				0.6		MHz
e_N	Total Output Noise	f=20Hz to 22KHz Play, max volume		500	800	µV
		f=20Hz to 22KHz Play, max attenuation		100	250	µV
		f=20Hz to 22KHz Mute		60	150	µV
SR	Slew Rate		5	8		V/µs
Ri	Input Resistance		22.5	30		KΩ
$R_{Var\ Out}$	Variable Output Resistance			30	100	Ω
$R_{load\ Var\ Out}$	Variable Output Load		2			KΩ
SVR	Supply Voltage Rejection	f=1kHz; max volume C_{SVR}=470µF; V_{RIP}=1V_{rms}	35	39		dB
		f=1kHz; max attenuation C_{SVR}=470µF; V_{RIP}=1V_{rms}	55	65		dB
T_M	Thermal Muting			150		°C
T_S	Thermal Shut-down			160		°C
MUTE STAND-BY & INPUT SELECTION FUNCTIONS						
V_{ST-BY}	Stand-by threshold		2.3	2.5	2.7	V
V_{MUTE}	Mute threshold		2.3	2.5	2.7	V
I_{qST-BY}	Quiescent Curren @ Stand-by			0.6	1	mA
A_{MUTE}	Mute Attenuation		50	65		dB
$I_{stbyBIAS}$	Stand-by bias current	Stand-by on V_{ST-BY}=5V V_{MUTE}=5V		80		µA µA
		Play or Mute	-20	-5		µA
$I_{muteBIAS}$	Mute bias current	Mute		1	5	µA
		Play		0.2	2	µA

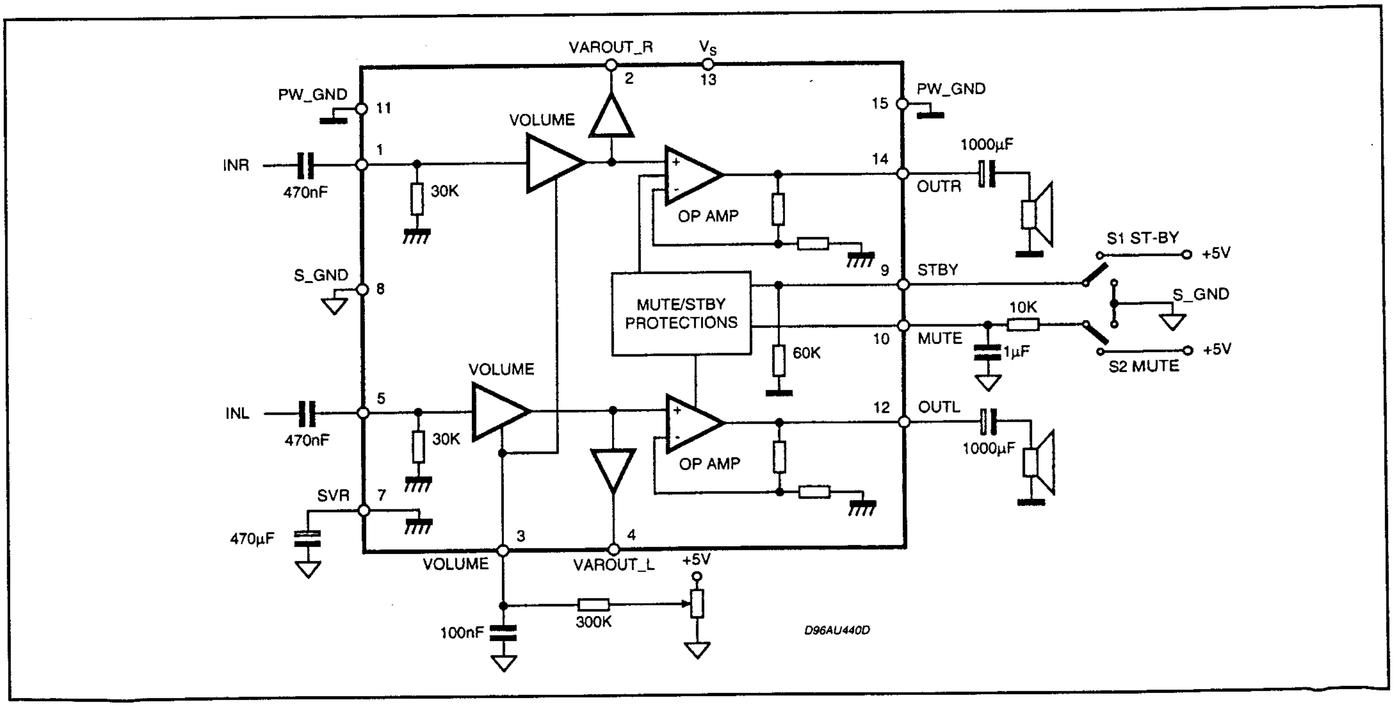
TDA7496
5+5W Amplifier With DC Volume Control

- 5+5W Output Power
- RL = 8Ω @THD = 10% VCC = 22V
- ST-BY and mute functions
- Low tur-on turn-off pop noise
- Linear volume control DC coupled
- With Power Op. Amp.
- No Boucherot Cell
- No ST-BY RC input network
- Single supply ranging up to 35V
- Short circuit protection
- Thermal Overload protection
- Internally fixed gain
- Soft Clipping
- Variable output after volume control circuit
- Multiwatt 15 package



Multiwatt 15
ORDERING NUMBER: TDA7495

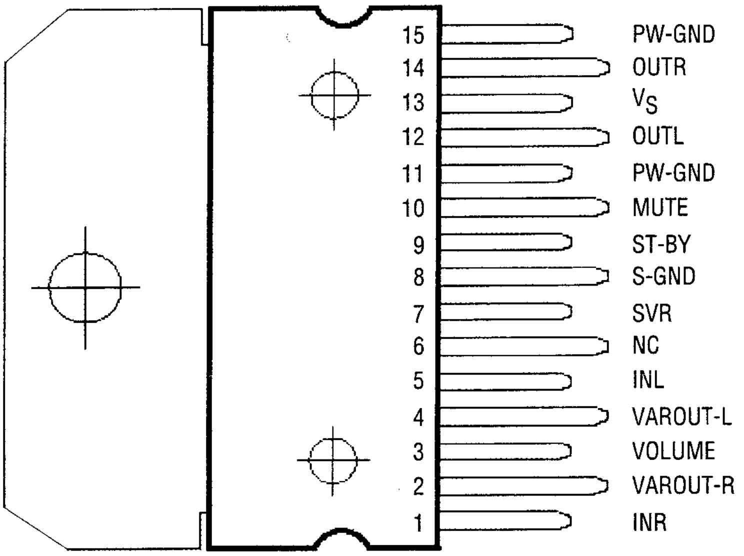
Block and Application Diagram


VAROUT_R
V_S
2
13
PW_GND
11
VOLUME
15
PW_GND
INR
470nF
1
30K
14
1000µF
OUTR
OP AMP
S1 ST-BY
+5V
9
STBY
S_GND
8
MUTE/STBY PROTECTIONS
10K
S_GND
10
MUTE
1µF
60K
+5V
S2 MUTE
VOLUME
INL
470nF
5
30K
12
OUTL
1000µF
OP AMP
SVR
7
470µF
3
4
VOLUME
VAROUT_L
+5V
300K
100nF
D96AU440D

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	DC Supply Voltage	35	V
V_{IN}	Maximum Input Voltage	8	Vpp
P_{tot}	Total Power Dissipation (Tamb = 80 °C)	15	W
Tamb	Ambient Operating Temperature	0 to 70	°C
Tstg, Tj	Storage and Junction Temperature	-40 to 150	°C
V_3	Volume CTRL DC voltage	7	V

PIN CONNECTION (Top view)



THERMAL DATA

Symbol	Parameter	Value	Unit
Rth j-case	Thermal Resistance Junction - case	Typ. = 4 Max. = 4.6	°C/W
Rth j-amb	Thermal Resistance Junction - ambient max.	35	°C/W

ELECTRICAL CHARACTERISTICS (Refer to the test circuit V_S = 22V R_L = 8Ω, R_g = 50Ω, T_{amb} =25

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_S	Supply Voltage Range		11		35	V
I_q	Total Quiescent Current			25	70	mA
DCV_{OS}	Output DC Offset Referred to SVR Potenial	No Input Signal	-650		650	mV
V_0	Quiescent Output Voltage			10		V
P_0	Output Power	THD = 10%; R_L = 8Ω;	5	5.3		W
		THD = 1%; R_L = 8Ω;		4		W
		THD = 10%; R_L = 4Ω; V_{CC} = 12V		2.1		W
		THD = 1%; R_L = 4Ω; V_{CC} = 12V		1.0		W
THD	Total Harmonic Distortion	Gv = 30dB; Po=1W; f=1KHz			0.4	%
I_{peak}	Output Peak Current	(internally limited)	1	1.3		A
Vin	Input Signal				2.8	Vrms
Gv	Closed Loop Gain	Vol Ctrl > 4.5V	28.5	30	31.5	dB

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
GvLine	Monitor Out Gain	Vol Ctrl > 4.5V; Zload > 30KΩ	-1.5	0	1.5	dB
A_{Min} Vol	Attenuation at Minimum Volume	Vol Ctrl < 0.5V	80			dB
BW				0.6		MHz
e_N	Total Output Noise	f=20Hz to 22KHz Play, max volume		500	800	µV
		f=20Hz to 22KHz Play, max attenuation		100	250	µV
		f=20Hz to 22KHz Mute		60	150	µV
SR	Slew Rate		5	8		V/µs
Ri	Input Resistance		22.5	30		KΩ
$R_{Var\ Out}$	Variable Output Resistance			30	100	Ω
$R_{load\ Var\ Out}$	Variable Output Load		2			KΩ
SVR	Supply Voltage Rejection	f=1kHz; max volume C_{SVR}=470µF; V_{RIP}=1Vms	35	39		dB
		f=1kHz; max attenuation C_{SVR}=470µF; V_{RIP}=1Vms	55	65		dB
T_M	Thermal Muting			150		°C
T_S	Thermal Shut-down			160		°C
MUTE STAND-BY & INPUT SELECTION FUNCTI						
$V_{ST\text{-}BY}$	Stand-by threshold		2.3	2.5	2.7	V
V_{MUTE}	Mute threshold		2.3	2.5	2.7	V
$I_{qST\text{-}BY}$	Quiescent Curren @ Stand-by			0.6	1	mA
A_{MUTE}	Mute Attenuation		50	65		dB
$I_{stbyBIAS}$	Stand-by bias current	Stand-by on $V_{ST\text{-}BY}$=5V V_{MUTE}=5V		80		µA µA
		Play or Mute	-20	-5		µA
$I_{muteBIAS}$	Mute bias current	Mute		1	5	µA
		Play		0.2	2	µA

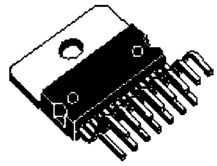
APPLICATION SUGGESTIONS

The recommended values of the external components are those shown on the application circuit of figure 1a. Different values can be used, the following table can help the designer.

COMPONENT	SUGGESTION VALUE	PURPOSE	LARGER SUGGESTION	SMALLER THAN SUGGESTION
R1	300K	Volume control circuit	Larger volume regulation time	Smaller volume regulation time
R2	10K	Mute time constant	Larger mute or/off time	Smaller mute on/off time
P1	50K	Volume control circuit		
C1	1000µF	Supply voltage bypass		Darger of Oscillation
C2	470nF	Input DC decoupling	Lower low frequency cutoff	Higher low frequency cutoff
C3	470nF	Input DC decoupling	Lower low frequency cutoff	Higher low frequency cutoff
C4	470µF	Ripple rejection	Better SVR	Worse SVR
C5	100nF	Volume control time	Larger volume regulation time	Smaller volume regulation time
C6	1000µF	Output DC decoupling	Lower low frequency cutoff	Higher low frequency cutoff
R7	1µF	Mute time constant	Larger mute or/off time	Smaller mute on/off time
C8	1000µF	Output DC decoupling	Lower low frequency cutoff	Higher low frequency cutoff
C9	100nF	Supply voltage bypass		Danger of oscillation

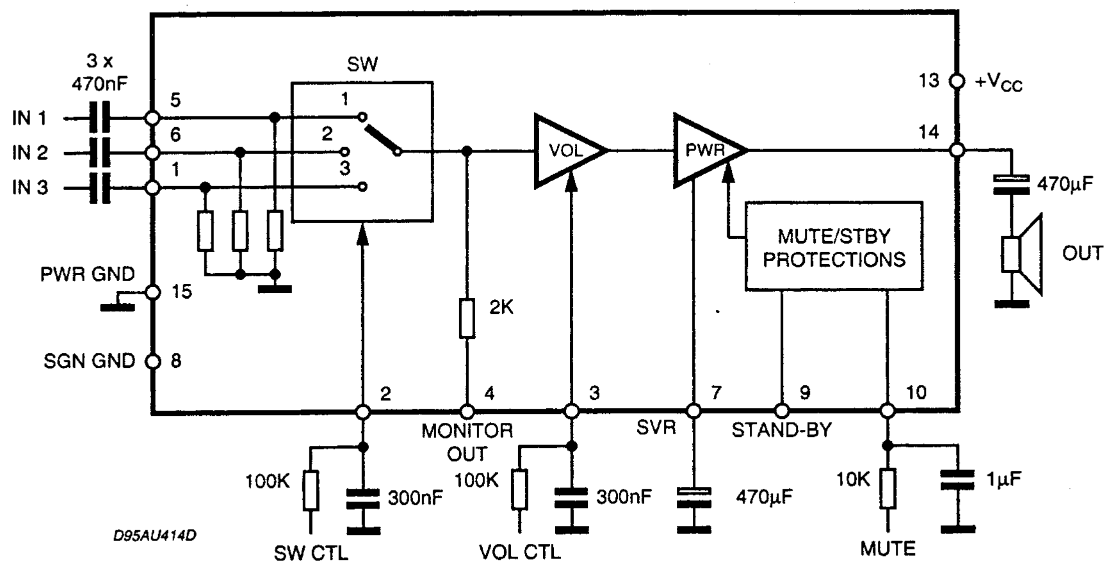
TDA7494
10W Amplifier With DC Volume Control

- 10W Output Power
- RL = □W @THD = 10% VCC = 28V
- ST-BY and mute functions
- With Power Op. Amp.
- No Boucherot Cell
- No ST-BY RC input network
- Signal line output before volume
- Controlling and muting
- 3 switchable voltage controlled
- Input Pins
- Single supply ranging up to 35V
- Short circuit protection
- Thermal Overload protection
- Internally fixed gain
- Soft Clipping
- Low turn-on turn-off pop noise



Multiwatt 15
ORDERING NUMBER: TDA7495

Block and Application Diagram

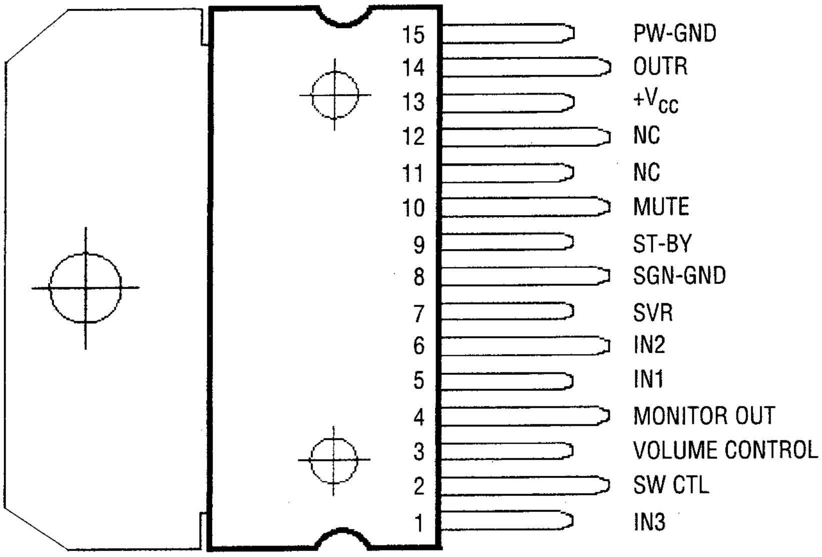

3 x
470nF
IN 1
IN 2
IN 3
5
6
1
SW
1
2
3
VOL
PWR
13
+V_{CC}
14
470µF
OUT
MUTE/STBY
PROTECTIONS
PWR GND
15
SGN GND
8
2K
2
4
3
7
9
10
MONITOR
OUT
SVR
STAND-BY
100K
300nF
100K
300nF
470µF
10K
1µF
SW CTL
VOL CTL
MUTE
D95AU414D

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	DC Supply Voltage	35	V
V_{IN}	Maximum Input Voltage	8	Vpp
P_{tot}	Total Power Dissipation (Tamb = 70 °C)	16	W
Tamb	Ambient Operating Temperature (1)	-20 to 85	°C
Tstg, Tj	Storage and Junction Temperature	-40 to 150	°C
$V2, V_3$	Volume CTRL DC voltage	7	V

(1) Operation between -20 to 85 °C guaranteed by correlation with 0 to 70 °C

PIN CONNECTION (Top view)



THERMAL DATA

Symbol	Parameter		Value	Unit
Rth j-case	Thermal Resistance Junction - case		Typ. = 3.8 Max. = 4.8	°C/W
Rth j-amb	Thermal Resistance Junction - ambient	max.	35	°C/W

ELECTRICAL CHARACTERISTICS

(Refer to the test circuit $V_S = 21V$ $R_L = 8\Omega$, $R_g = 50\Omega$, $T_{amb} = 25^oC$; unless otherwise specified.)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_S	Supply Voltage Range		11		35	V
I_q	Total Quiescent Current			22	50	mA
DCV_{OS}	Output DC Offset Referred to SVR Potential	No Input Signal	-400		400	mV
V_0	Quiescent Output Voltage	Vs = 28V		14		V
P_0	Output Power	THD = 10%; $R_L = 8\Omega$; $V_{CC} = 28V$	8	10		W
		THD = 1%; $V_{CC} = 28V$	6	8		
		THD = 10%; $V_{CC} = 21V$	5	5.5		W
		THD = 1%; $V_{CC} = 21V$	3.5	4		W
		THD = 10%; $R_L = 4\Omega$; $V_{CC} = 21V$	5	7.5		W
		THD = 1%; $V_{CC} = 21V$	3.9	5.5		W
		THD = 10%; $V_{CC} = 18V$	4.5	6		W
		THD = 1%; $V_{CC} = 18V$	3.5	4.5		W
		THD = 10%; $R_L = 8\Omega$; $V_{CC} = 18V$	3.5	3.75		W
		THD = 1%; $V_{CC} = 18V$	2.5	2.85		W

ELECTRICAL CHARACTERISTICS (continued)

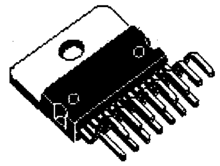
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
THD	Total Harmonic Distortion	Gv=26dB; Po=1W; f=1KHz			0.4	%
Ipeak	Output Peak Current	(internally limited)	1.4	1.9		A
Top	Operating Temperature		0		70	°C
Vin	Input Signal				2.8	Vrms
Gv	Closed Loop Gain	Vol Ctrl > 4.5V	24.5	26	27.5	dB
GvLine	Monitor Out Gain	RLOAD Mon = ∞	-3	-1.5	0	dB
AMin Vol	Attenuation at Minimum Volume	Vol Ctrl < 0.5V	80			dB
BW				0.6		MHz
e_N	Total Output Noise	f=20Hz to 22KHz Play, max volume		350	700	µV
		f=20Hz to 22KHz Play, max attenuation		60	100	µV
		f=20Hz to 22KHz Mute		30	50	µV
SR	Slew Rate		5	8		V/µs
Ri	Input Resistance		22.5	30		KΩ
RMon	Monitor Output Resistance		1.4	2	3	KΩ
Rload Mon	Monitor Output Load		30			KΩ
SVR	Supply Voltage Rejection	f=1kHz; max volume CSVR=470µA; VRIP=1Vrms	36	43		dB
		f=1kHz; max attenuation CSVR=470µA; VRIP=1Vms	60	73		dB
TM	Thermal Muting			150		°C
Ts	Thermal Shut-down			160		°C
VST-BY	Stand-by threshold		2.3	2.5	2.7	V
VMUTE	Mute threshold		2.3	2.5	2.7	V
Sel #1	Control Voltage	input#1 selected	0		1	V
Sel #2	Control Voltage	input#2 selected	2.3		2.7	V
Sel #3	Control Voltage	input#3 selected	4		5	V
IqST-BY	Quiescent Curren @ Stand-by			0.6	1	mA
AMUTE	Mute Attenuation		60	75		dB
IstbyBIAS	Stand-by bias current	Stand-by on VST-BY=5V VMUTE=5V		80	150	µA
		Play or Mute		2	20	µA
ImuteBIAS	Mute bias current	Mute		1.5	5	µA
		Play		0.2	10	µA
IswitchBIAS	Switch bias current	input#1 selected		-0.5	5	µA
		input#2 selected		1	10	µA
		input#3 selected		1.5	20	µA

STV5112
RGB High Voltage Video Amplifier

DESCRIPTION

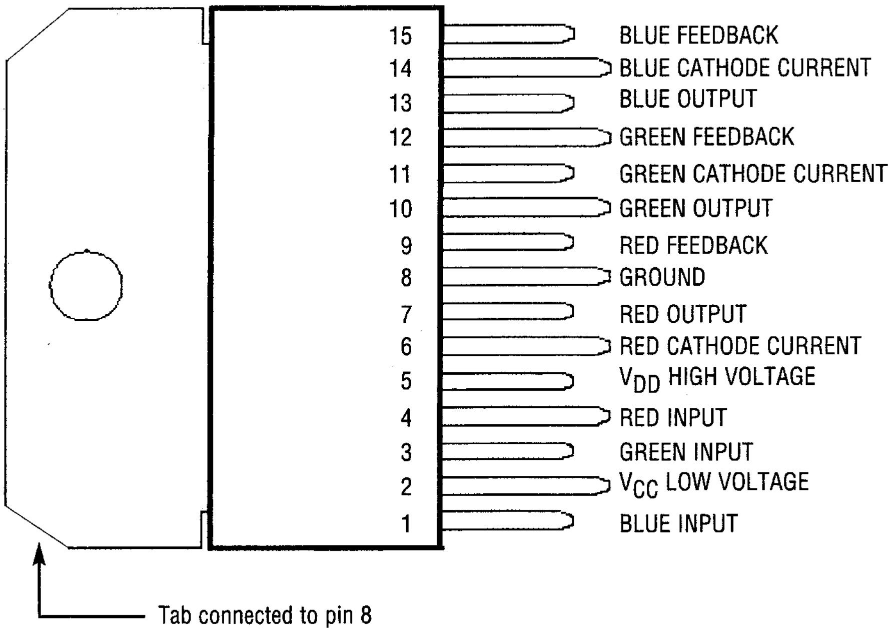
The STV5112 includes three video amplifiers designed with a high voltage bipolar / CMOS / DMOS technology (BCD). It drives directly the three cathodes and is protected against flashovers. Thanks to its three cathode current outputs, the STV5112 can be used with both parallel and sequential samplingapplications.

- BANDWIDTH : 8MHz TYPICAL
- SUPPLY VOLTAGE : 220V TYPICAL
- RISE AND FALL TIME : 50ns TYPICAL
- CRT CATHODE CURRENT OUTPUTS FOR PARALLEL OR SEQUENTIAL CUT-OFF OR DRIVE ADJUSTMENT
- FLASHOVER PROTECTION
- POWER DISSIPATION : 3.6W



Multiwatt 15
ORDERING NUMBER: TDA7495

PIN CONNECTION (Top view)

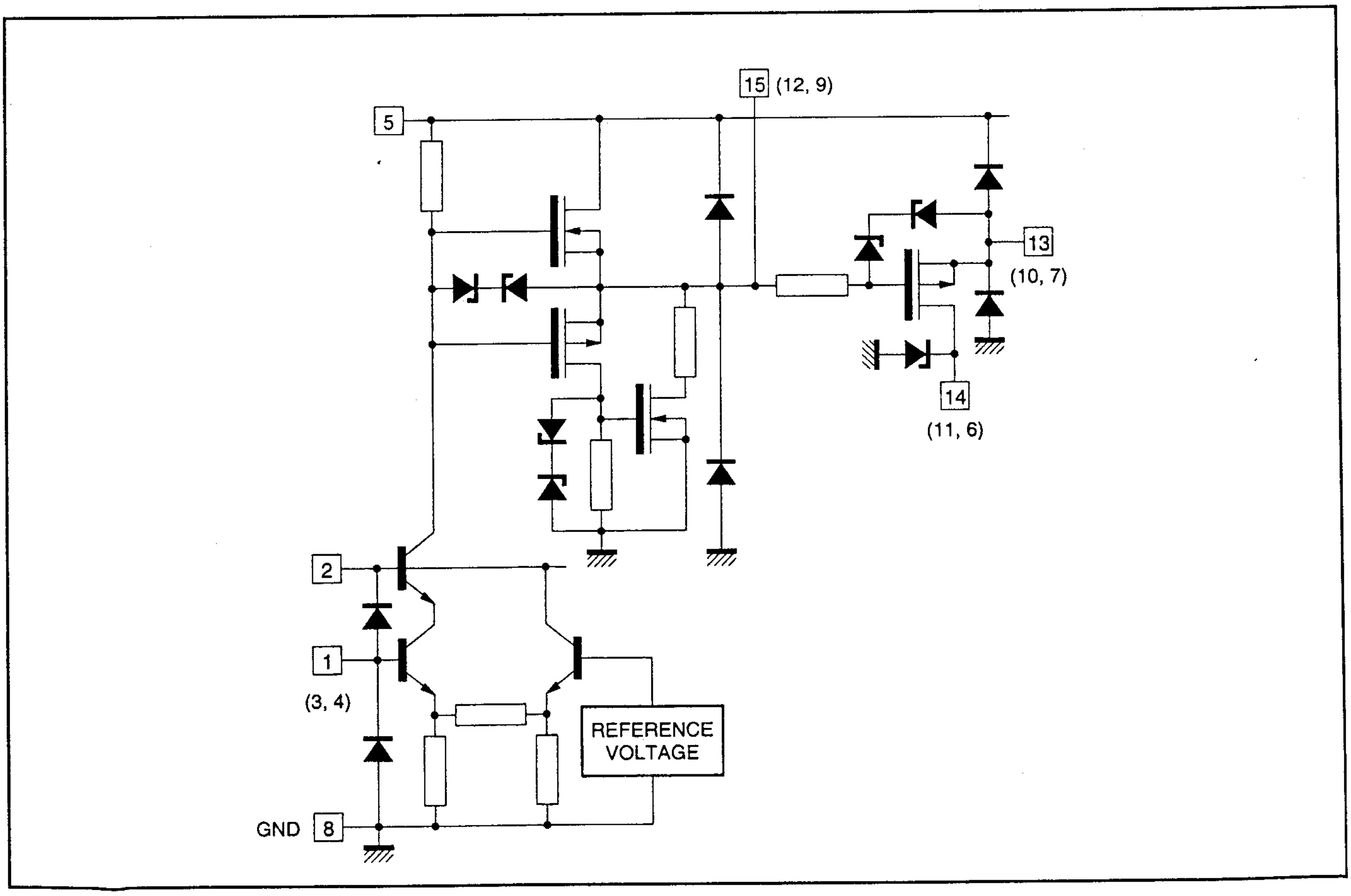

15 BLUE FEEDBACK
14 BLUE CATHODE CURRENT
13 BLUE OUTPUT
12 GREEN FEEDBACK
11 GREEN CATHODE CURRENT
10 GREEN OUTPUT
9 RED FEEDBACK
8 GROUND
7 RED OUTPUT
6 RED CATHODE CURRENT
5 V_{DD} HIGH VOLTAGE
4 RED INPUT
3 GREEN INPUT
2 V_{CC} LOW VOLTAGE
1 BLUE INPUT

Tab connected to pin 8

PIN FUNCTION

N°	Function	Description
1	Blue Input	Input of the "blue" amplifier. It is a virtual ground with 2.5V bias voltage and 75µA input bias current.
2	VCC	Low voltage power supply, typically 9V.
3	Green Input	Input of the "green" amplifier. It is a virtual ground with 2.5V bias voltageb and 75µA input bias current.
4	Red Input	Input of the "red" amplifier. It is a virtual ground with 2.5V bias voltageb and 75µA input bias current.
5	V_{DD}	High voltage power Supply, typically 220V.
6	Red Cathode Current	Provides the video processor with a copy of the DC current flowing into the red cathode, for automatic cut-off or gain adjustment. If this control is not used. Pin 6 must be grounded.
7	Red Output	Output driving the red cathode. Pin 7 is internally protected against CRT arc discharges by a diode limiting the output voltage V_{DD}.
8	Ground	Also connected to the heatsink.
9	Red Feedback	Output driving the feedback resistor network for the red amplifier
10	Green Output	Output driving the greeen cathode. Pin 10 is internally protected against CRT arc discharges by a diode limiting the output voltage V_{DD}.
11	Green Cathode Current	Provides the video processor with a copy of the DC current flowing into the green cathode, for automatic cut-off or gain adjustment. If this control is not used. Pin 11 must be grounded.
12	Green Feedback	Output driving the feedback resistor network for the green amplifier
13	Blue Output	Output driving the blue cathode. Pin 13 is internally protected against CRT arc discharges by a diode limiting the output voltage V_{DD}.
14	Blue Cathode Current	Provides the video processor with a copy of the DC current flowing into the blue cathode, for automatic cut-off or gain adjustment. If this control is not used. Pin 14 must be grounded.
15	Blue Feedback	Output driving the feedback resistor network for the blue amplifier.

BLOCK DIAGRAM OF EACH CHANNEL



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{DD}	Supply High Voltage	Pin 5	250	V
V_{CC}	Supply Low Voltage	Pin 2	20	V
	Output Current	Pins 7-10-13		
I_{OD}	to V_{DD}		Protected	
I_{OG}	to Ground		8	mA
	Output Current < 50µs duration	Pins 9-12-15		
I_{FD}	to V_{DD}		45	mA
I_{FG}	to Ground		45	mA
I_{I}	Input Current	Pins 1-3-4	60	mA
T_{j}	Junction Temperature		150	°C
T_{oper}	Operating AmbientTemperature		0, +70	°C
T_{stg}	Storage Temperature		-20, +150	°C

THERMAL DATA

Symbol	Parameter		Value	Unit
Rth j-case	Thermal Resistance Junction - case	max.	3	°C/W
Rth j-amb	Thermal Resistance Junction - ambient	Typ.	35	°C/W

ELECTRICAL CHARACTERISTICS (V_{CC}= 9V; V_{DD} = 240V; T_{amb} =25°C; AV = 55unless otherwise specified.)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{DD}	High Supply Voltage (Pin5)			220	240	V
V_{CC}	Low Supply Voltage (Pin2)		7.5	9	10	V
I_{DD}	High Voltage Supply internal DC current (without current due to the feedbaçck network)	V_{OUT} = 120V		9.5	15	mA
I_{CC}	Low Voltage Supply internal DC current			38	55	mA
V_{sath}	Output Saturation Voltage (High level) (Pins 7-10-13)	I_{O} = 10µA		5		V
R_{ON}	Output Mos Transistor (Low level) (Pins 7-10-13)			1.7		kΩ
BW	Bandwith at -3dB	Measured on CRT cathodes (C_{LOAD} = 10pF; $R_{PROTECT}$ = 1kΩ, V_{OUT} = 120V, Δ V_{OUT} = 100V_{pp})		8		MHz
t_R, t_F	Rise & Fall Time	Measured between 10% & 90% of output pulse (C_{LOAD} = 10pF; $R_{PROTECT}$ = 1kΩ, V_{OUT} = 120V, Δ V_{OUT} = 100V_{pp})		50		ns
G_{O}	Open Loop Gain		47	50		dB
	Open Loop Gain Difference between 2 channels		-1.5	0	1.5	dB
	Open Loop Gain Temperature Coefficient			0		dB/°C
P	Internal Power Dissipation (see calculation below)	V_{OUT} = 2MHz, 70 V_{PP} sine wave, V_{BLACK} = 170V, C_L = 20pF R_F= 68kΩ		3.6		W
V_{REF}	Internal Voltage Reference (Pins 1,3,4)	V_{OUT} = 120V	2.3	2.5	2.7	V
	Voltage Reference Temperature Coefficient			0		mV/°C
I_{IB}	Input Bias Current (Pins 1,3,4)	V_{OUT} = 120V		75		µA
R_{I}	Input Resistance			4		kΩ
ESD	ESD Human Body Model		1.2			kV

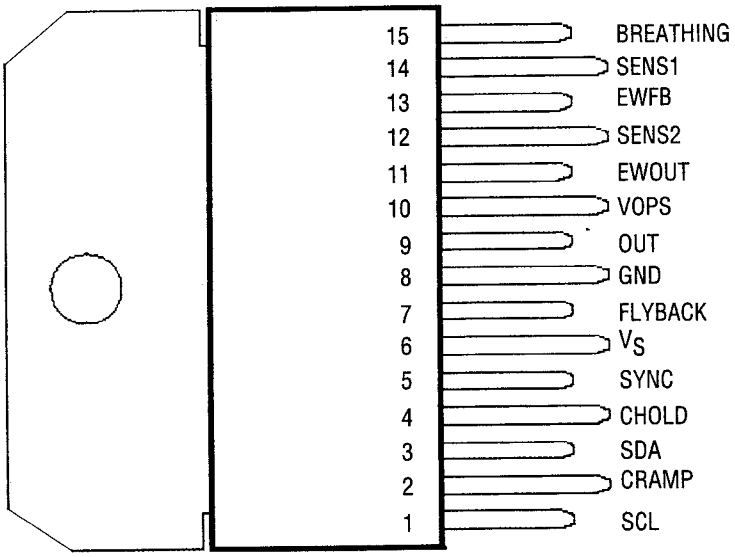
STV9306
Bus controlled Vertical Deflection System With East/West Correction Output Circuit

DESCRIPTION

The STV9306 is a fully I^2C controlled vertical deflection IC designed for use in 110°, 4/3 or 16/9 CRT applications. It integrates both the vertical deflection and E/W correction circuitries necessary in design of a 110° chassis.

- FULLY I2C CONTROLLED
- DMOSPOWER HALF-BRIDGE AMPLIFIER
- DC COUPLED OPERATION
- INTERNAL FLYBACK GENERATOR (UP TO 60V)
- SELF ADAPTED SAWTOOTH (50/60Hz)
- 100 Hz OPERATION
- VERTICAL LINEARITY, AMPLITUDE AND CENTERING ADJUSTMENTS
- HORIZONTAL WIDTH, PINCUSHION, TRAPEZOID AND CORNER ADJUSTMENTS
- BREATHING CORRECTION
- 4/3, 16/9 CRT APPLICATION
- THERMAL PROTECTION
- LINEAR VERTICAL ZOOM FUNCTION
- E/W CLASS AOUTPUT
- LOW EXTERNAL COMPONENTS

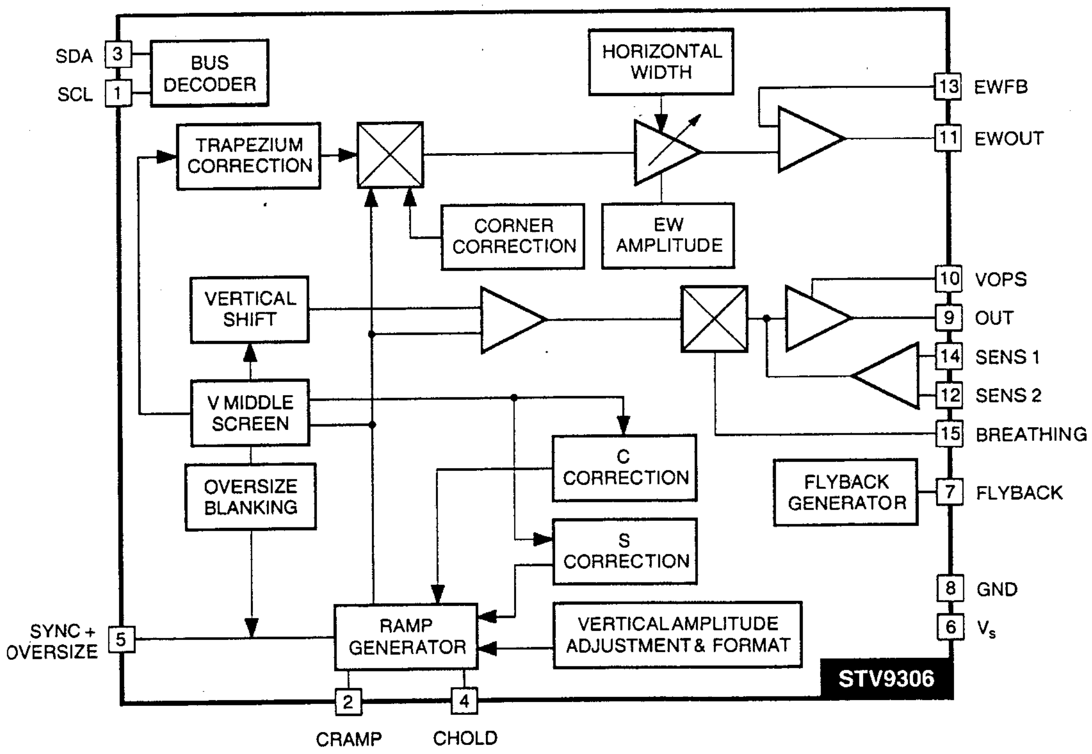
PIN CONNECTION (Top view)


15 BREATHING
14 SENS1
13 EWFB
12 SENS2
11 EWOUT
10 VOPS
9 OUT
8 GND
7 FLYBACK
6 V_S
5 SYNC
4 CHOLD
3 SDA
2 CRAMP
1 SCL

PIN LIST

Pin	Symbol	Description
1	SCL	I²C Bus Clock
2	CRAMP	Ramp Capacitor
3	SDA	I²C Bus Data
4	CHOLD	Hold Capacitor
5	SYNC	Sync Input
6	Vs	Supply Voltage
7	FLYBACK	Flyback Output
8	GND	Ground
9	OUT	Vertical Output
10	VOPS	Vertical Output Power Supply
11	EWOUT	EW Output
12	SENS2	Vertical Current Sense 2
13	EWFB	EW Feedback
14	SENS1	Vertical Current Sense 1
15	BREATHING	Breathing Input

BLOCK DIAGRAM


SDA
3
SCL
1
BUS DECODER
HORIZONTAL WIDTH
13
EWFB
11
EWOUT
TRAPEZIUM CORRECTION
CORNER CORRECTION
EW AMPLITUDE
VERTICAL SHIFT
10
VOPS
9
OUT
14
SENS 1
12
SENS 2
V MIDDLE SCREEN
15
BREATHING
C CORRECTION
OVERSIZE BLANKING
FLYBACK GENERATOR
7
FLYBACK
S CORRECTION
8
GND
6
V_S
SYNC + OVERSIZE
5
RAMP GENERATOR
VERTICAL AMPLITUDE ADJUSTMENT & FORMAT
STV9306
2
4
CRAMP
CHOLD

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	Supply Voltage	35	V
V_{OUT}	Flyback Peak Voltage	60	V
V_I	Input Voltage AT PINS 1,3,5,12,13,14,15	–0.3, Vs	V
V_{IS}	Input Voltage AT PINS 2,4	10	V
E/W OUT	East / West Output	60	V
T_{oper}	Operating Temperature	-10, + 70	°C
T_{stg}	Storage Temperature	-55, +150	°C
T_j	Junction Temperature	+150	°C

THERMAL DATA

Symbol	Parameter		Value	Unit
Rth j-c	Thermal Resistance Junction - case	max.	3	°C/W
Tt	Temperature for Thermal Shutdown	Min.	140	°C

TDA16846

Controller for Switch Mode Power Supplies Supporting Low Power Standby and Power Factor Correction

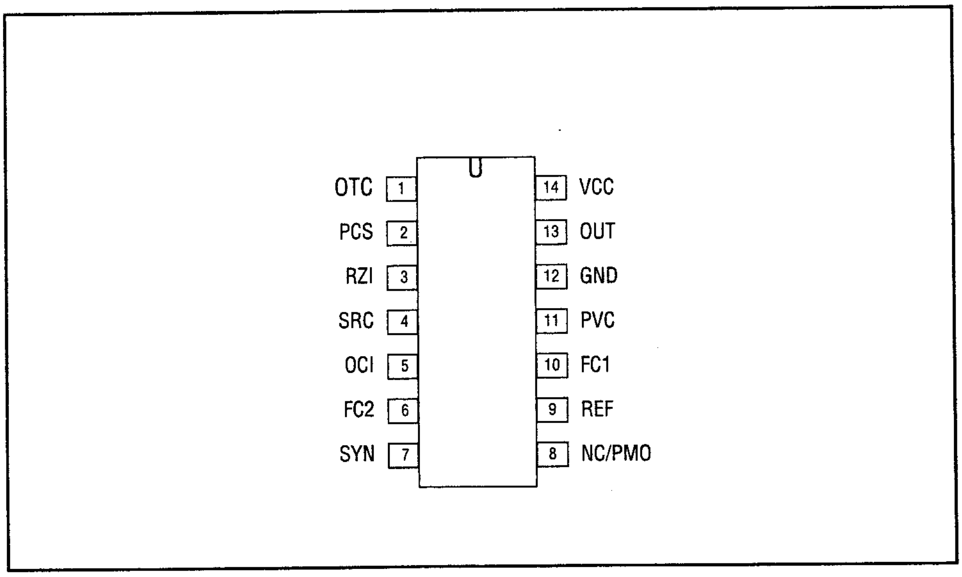
FEATURES

- Line Current Consumption with PFC
- Low Power Consumption
- Stable and Adjustable Standby Frequency
- Very Low Start-up Current
- Soft-Start for Quiet Start-up
- Free usable Fault Comparators
- Synchronization and Fixed Frequency Facility
- Over- and Undervoltage Lockout
- Switch Off at Mains Undervoltage
- Temporary high power circuit (only TDA 16847)
- Mains Voltage Dependent Fold Back Point Correction
- Continuous Frequency Reduction with Decreasing Load
- Adjustable and Voltage Dependent Ringing Suppression Time

DESCRIPTION

The TDA 16846 is optimized to control free running or fixed frequency flyback converters with or without Power Factor Correction (Current Pump). To provide low power consumption at light loads, this device reduces the switching frequency continuously with load, towards an adjustable minimum (e. g. 20 kHz in standby mode). Additionally, the start up current is very low. To avoid switching stresses of the power devices, the power transistor is always switched on at minimum voltage. A special circuit is implemented to avoid jitter. The device has several protection functions: VCC over- and underwoltage, mains undervoltage, current limiting and 2 free usable fault comparators. Regulation can be done by using the internal error amplifier or an opto coupler feedback (additional input). The output driver is ideally suited for driving a power MOSFET, but it can also be used for a bipolar transistor. Fixed frequency and synchronized operation are also possible. The TDA16846 is suited for TV-, VCR- sets and SAT receivers. It also can be good used in PC monitors. The TDA16847 is identical with TDA16846 but has an additional power measurement output (pin 8) which can be used for a Temporary High Power Circuit.

Pin description



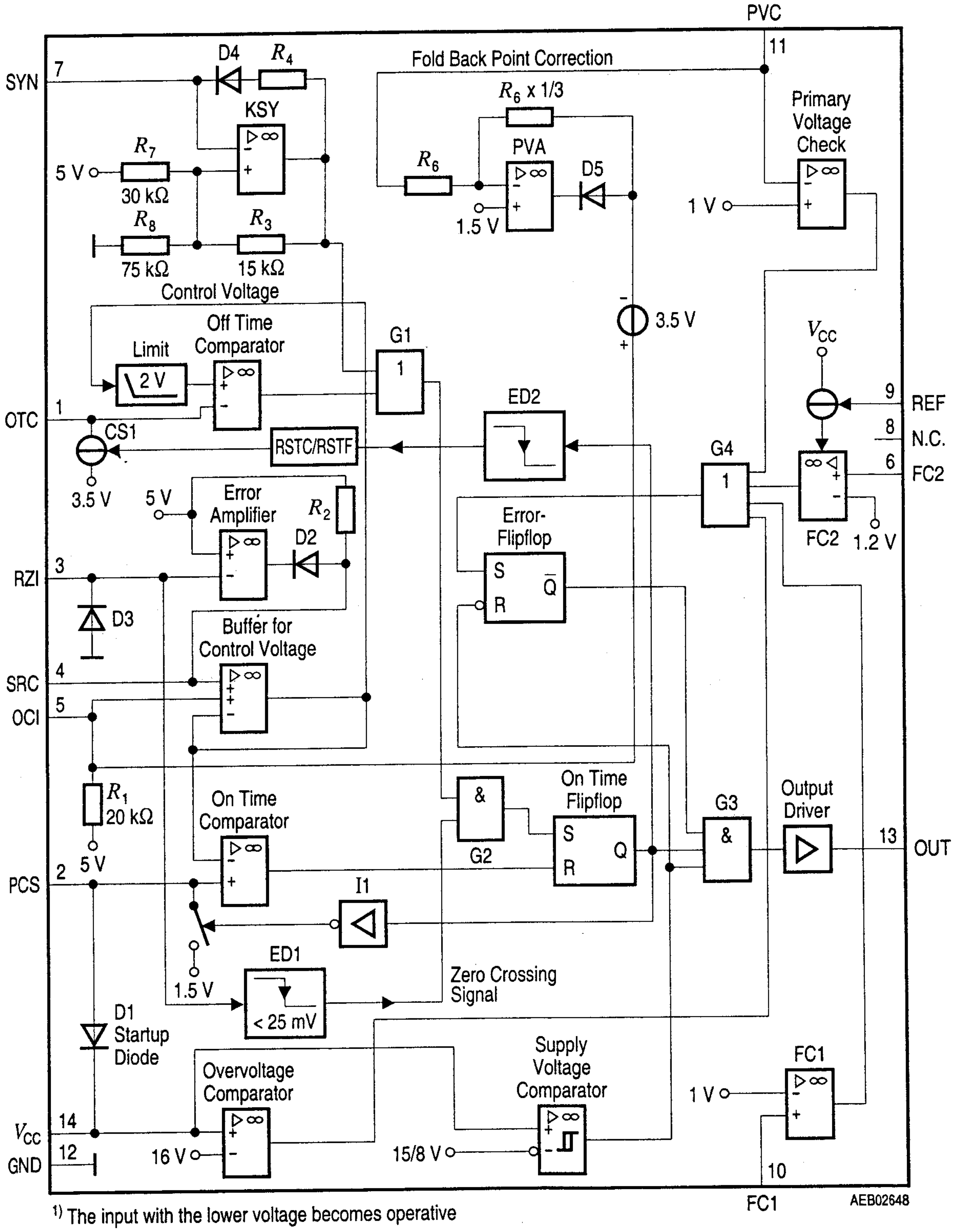
PIN DEFINITIONS AND FUNCTIONS

Pin	Symbol	Function
1	OTC	Off Time Circuit
2	PCS	Primary Current Simulation
3	RZI	Regulation and Zero Crossing Input
4	SRC	Soft-Start and Regulation Capacitor
5	OCI	Opto Coupler Input
6	FC2	Fault Comparator 2
7	SYN	Synchronization Input
8	NC/PMO	Not Connected (TDA16846)/PMO (TDA16847
9	REF	Reference Voltage and Current
10	FC2	Fault Comparator 1
11	PVC	Primary Voltage Check
12	GND	Ground
13	OUT	Output
14	VCC	Supply Voltage

SHORT DESCRIPTION OF THE PIN FUNCTIONS

N°	Function	Description
1	OTC	A parallel RC-circuit between this pin and ground determines the ringing suppression time and the standby-frequency.
2	PCS	A capacitor between this pin and ground and a resistor between this pin and the positive terminal of the primary elcap quantifies the max. possible output power of the SMPS.
3	RZI	This is the input of the error amplifier and the zero crossing input. The output of a voltage divider between the control winding and ground is connected to this input. If the pulses at pin 3 exceed a 5V threshold, the control voltage at pin 4 is lowered.
4	SRC	This is the pin for the control voltage. A capacitor has to be connected between this pin and ground. The value of this capacitor determines the duration of the softstart and the speed of the control.
5	OCI	If an opto coupler for the control is used, it's output has to be connected between this pin and ground. The voltage divider at pin3 has then to be changed, so that the pulses at pin3 are below 5 V.
6	FC2	Fault comparator 2: If a voltage > 1.2 V is applied to this pin, the SMPS stops.
7	SYN	If fixed frequency mode is wanted, a parallel RC circuit has to be connected between this pin and ground. The RC-value determines the frequency. If synchronized mode is wanted, sync pulses have to be fed into this pin.
8	NC/PMO	Not connected (TDA16846). / This is the power measurement output of the Temporary High Power Circuit. A capacitor and a RC-circuit has to be connected between this pin and ground (TDA16847).
9	REF	Output for reference voltage (5 V). With a resistor between this pin and ground the fault comparator 2 (pin 6) is enabled.
10	FC2	Fault comparator 1: If a voltage > 1. V is applied to this pin, the SMPS stops.
11	PVC	This is the input of the primary voltage check. The voltage at the anode of the primary elcap has to be fed to this pin via a voltage divider. If the voltage of this pin falls below 1 V, the SMPS is switched off. A second function of this pin is the primary voltage dependent fold back point correction (only active in free running mode).
12	GND	Common ground.
13	OUT	Output signal. This pin has to be connected across a serial resistor with the gate of the power transistor.
14	VCC	Connection for supply voltage and startup capacitor. After startup the supply voltage is produced by the control winding of the transformer and rectified by an external diode.

BLOCK DIAGRAM


PVC
11
SYN
7
D4
R_4
KSY
Fold Back Point Correction
R_6 x 1/3
R_6
PVA
D5
1.5 V
Primary Voltage Check
1 V
R_7
5 V
30 kΩ
R_8
75 kΩ
R_3
15 kΩ
Control Voltage
Off Time Comparator
Limit
2 V
G1
1
3.5 V
V_{CC}
OTC
1
CS1
3.5 V
RSTC/RSTF
ED2
9
REF
8
N.C.
6
FC2
G4
1
5 V
Error Amplifier
R_2
D2
Error-Flipflop
S
R
Q̄
FC2
1.2 V
RZI
3
D3
Buffer for Control Voltage
SRC
4
OCI
5
R_1
20 kΩ
5 V
On Time Comparator
&
G2
On Time Flipflop
S
R
Q
G3
&
Output Driver
13
OUT
PCS
2
I1
1.5 V
ED1
< 25 mV
Zero Crossing Signal
D1 Startup Diode
Overvoltage Comparator
Supply Voltage Comparator
FC1
1 V
V_{CC}
14
GND
12
16 V
15/8 V
10
FC1
AEB02648

[1] The input with the lower voltage becomes operative

TCDT1100(G) Series
Optocoupler with Phototransistor Output

DESCRIPTION

The TCDT1100(G) series consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 6-lead plastic dual inline package. The elements are mounted on one leadframe using a coplanar technique, providing a fixed distance between input and output for highest safety requirements.

APPLICATIONS

Circuits for safe protective separation against electrical shock according to safety class II(reinforced isolation):

- For application class I - IV at mains voltage 3 300V
- For application class I - III at mains voltage 3 600V

according to VDE 0884, table 2, suitable for:

Switch-mode power supplies, computer peripheral interface, microprocessor system interface, line receiver.

These couplers perform safety functions according to the following equipment standards:

- VDE0884

Optocoupler providing protective separation

- VDE0804

Telecommunication apparatus and data processing

- VDE0805 / IEC950 / EN60950

Office machines (applied for reinforced isolation for mains voltage 3 400 VRMS)

- VDE0860 / IEC65

Safety for mains-operated electronic and related household apparatus

Input (Emitter)

Parameter	Test Conditions	Symbol	Value	Unit
Reverse Voltage		V_R	5	V
Forward current		I_F	60	mA
Forward surge current		I_{FSM}	3	A
Power dissipation	Tamb = 25°C	P_V	100	mW
Junction Temperature		T_j	125	°C

Output (Detector)

Parameter	Test Conditions	Symbol	Value	Unit
Collector emitter voltage		V_{CEO}	32	V
Emitter Collector voltage		I_C	7	V
Collector current		I_{CM}	50	MA
Collector peak current		I_{CM}	100	MA
Power dissipation	Tamb = 25°C	P_V	100	mW
Junction Temperature		T_j	125	°C

Coupler

Parameter	Test Conditions	Symbol	Value	Unit
Isolation test voltage		V_{IO}	3.75	KV
Total power dissipation	Tamb = 25°C	P_{tot}	250	MW
Ambient temperature range		T_{amb}	-55 to +100	°C
Storage temperature range		T_{stg}	-55 to +125	°C
Soldering Temperature	2mm from case t ☐ 10 s	T_{sd}	260	°C

MAXIMUM SAFETY RATINGS (according to VDE 0884)

Input (Emitter)

Parameters	Test Conditions	Symbol	Value	Unit
Forward current	I_{Si}	130	mA	

MAXIMUM SAFETY RATINGS[1] (according to VDE 0884)

Input (Emitter)

Parameters	Test Conditions	Symbol	Value	Unit
Forward current		I_{Si}	130	mA

Output (Detector)

Parameters	Test Conditions	Symbol	Value	Unit
Power dissipation	Tamb = $25_{\circ}$C	P_{Si}	265	mW

Coupler

Parameters	Test Conditions	Symbol	Value	Unit
Rated impulse voltage		V_{IOTM}	6	kV
Safety temperature		T_{Si}	150	°C

[1] *This device is used for protective separation against electrical shock only within the maximum safety ratings. This must be ensured by using protective circuits in the applications.*

ELECTRICAL CHARACTERISTICS T_{amb} = 25 □ C

Input (Emitter)

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Forward voltage	I_F= 50 mA	V_F		1.25	1.6	V
Breakdown voltage	I_C = 100-A	$V_{(BR)}$	5			V
Junction capacitance	V_R = 0, f = 1 MHz	V_J		50		pF

Output (Detector)

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Collector emitter breakdown voltage	IC = 1 mA	$V_{(BR)CEO}$	32			V
Emitter collector breakdown voltage	IE = 100-A	$V_{(BR)CEO}$	7			V
Collector emitter cut off current	VCE = 20V, IF	I_{CEO}		200		NA

Coupler

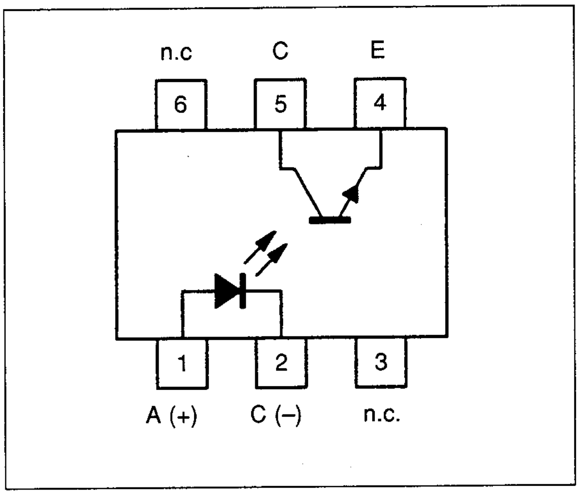
Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Ac isolation tes voltage(RMS)	f = 50 Hz, t= 1 s	V_{IO}[2]	3.75			V
Collector / emitter saturation voltage	I_F = 10 mA, I_C = 1 mA	V_{CEsat}			0.3	V
Cut off frequency	V_{CE} = 5V, I_F = 10 mA, R_L = 100	f_c		110		kHz
Coupling capacitance	f = 1 MHz	ck		0.3		pF

[2] *Related to standard climate 23/50 DIN 50014*

Current Transfer Ratio (CTR)

Parameters	Test Conditions	Typ.	Symbol	Min.	Typ.	Max.	Unit
I_C/I_F	V_{CE} = 5V, IF =10 mA	TCDT1100(G)	CTR	0.40			
I_C/I_F	V_{CE} = 5V, IF =10 mA	TCDT1101(G)	CTR	0.40		0.80	
I_C/I_F	V_{CE} = 5V, IF =10 mA	TCDT1102(G)	CTR	0.63		1.25	
I_C/I_F	V_{CE} = 5V, IF =10 mA	TCDT1103(G)	CTR	1.00		2.00	

Pin Connection

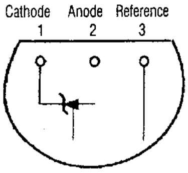


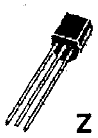
TL431

Programmable Voltage Reference

- Adjustable output voltage: Vref to 36V
- Sink current capability: 1 to 100 mA
- Typical output impedance: 0.22W
- 1% and 2% voltageprecision

TO92
(Top view)





Z
TO92

DESCRIPTION

The TL431 is a programmable shunt voltage reference with guaranteed temperature stability over the entire temperature range of operation. The outputvoltagemaybe set to any value between Vref (approximately 2.5V) and 36V with two external resistors. The TL431 operates with a wide current range from 1 to 100mA with a typical dynamic impedance of 0.22W

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{KA}	Cathode to Anode Voltage		37	V
I_K	Continuous Cathode Current Range		-100 to +150	mA
I_{ref}	Reference Input Current Range		–0.05 to +10	mA
T_{oper}	Operating Free-airT emperature Range	TL431C/AC	0 to + 70	°C
		TL431I/AI	-40 to +85	
T_{stg}	Storage Temperature Range		-65, +150	°C

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{KA}	Cathode to Anode Voltage	V_{ref} to 36	V
I_K	Cathode Current	1 to 100	mA

ELECTRICAL CHARACTERISTICS T_{amb} = 25 °C (unless otherwise specified)

Symbol	Parameters	TL431C			TL431AC			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{ref}	Reference Input Voltage - (figure 1) $V_{KA} = V_{ref}$, I_K = 10mA T_{amb} = 25°C $T_{min.} \leq T_{amb} \leq T_{max.}$	2.44 2.43	2.495	2.55 2.567	2.47 2.453	2.495	2.52 2.537	V
ΔV_{ref}	Reference Input Voltage Deviation Over Temperature Range - (figure 1, note1) $V_{KA} = V_{ref}$, I_K = 10mA, $T_{min.} \leq T_{amb} \leq T_{max.}$		3	17		3	15	mV
$\frac{\Delta V_{ref}}{\Delta V_{KA}}$	Ratio of Change in Reference Input Voltage to Change in Cathode to Anode Voltage , (figure 2) I_K = 10mA ΔV_{KA} = 10V to V_{ref} ΔV_{KA} = 36V to 10V		-1.4 -1	-2.7 -2		-1.4 -1	-2.7 -2	mV/V
I_{ref}	Reference Input Current - (figure 2) I_K = 10mA, R_1 = 10kΩ, $R_2 = \infty$ T_{amb} = 25°C $T_{min.} \leq T_{amb} \leq T_{max.}$			5.2			5.2	µA
ΔI_{ref}	Reference Input Current Deviation Over Temperature Range - (figure 2) I_K = 10mA, R_1 = 10kΩ, $R_2 = \infty$ $T_{min.} \leq T_{amb} \leq T_{max.}$		0.4	1.2		0.4	1.2	µA
I_{min}	Minimum Cathode Current for Regulation - (figure 1) $V_{KA} = V_{ref}$		0.5	1		0.5	0.6	mA
I_{off}	Off-State Cathode Current - (figure 3)		2.6	1000		2.6	1000	nA
$\lvert Z_{KA}\rvert$	Dynamic Impedance - (figure 1, note 2) $V_{KA} = V_{ref}$, ΔI_K = 1 to 100 mA, f ≤ 1kHz		0.22	0.5		0.22	0.5	Ω

Notes: 1. ΔV_{ref} *is defined as the difference between the maximum and minimum values obtained over the full temperature range.*

Figure 1: Test Circuit for VKA = Vref

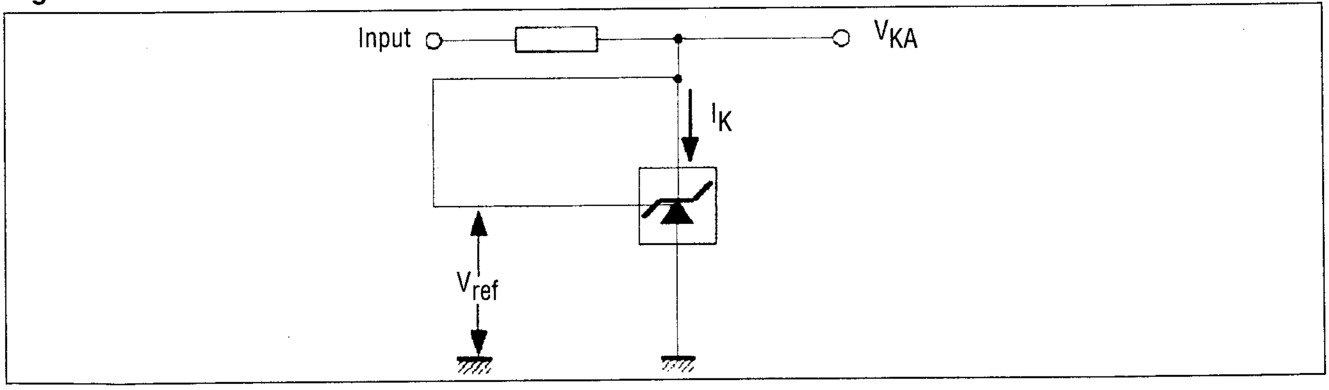
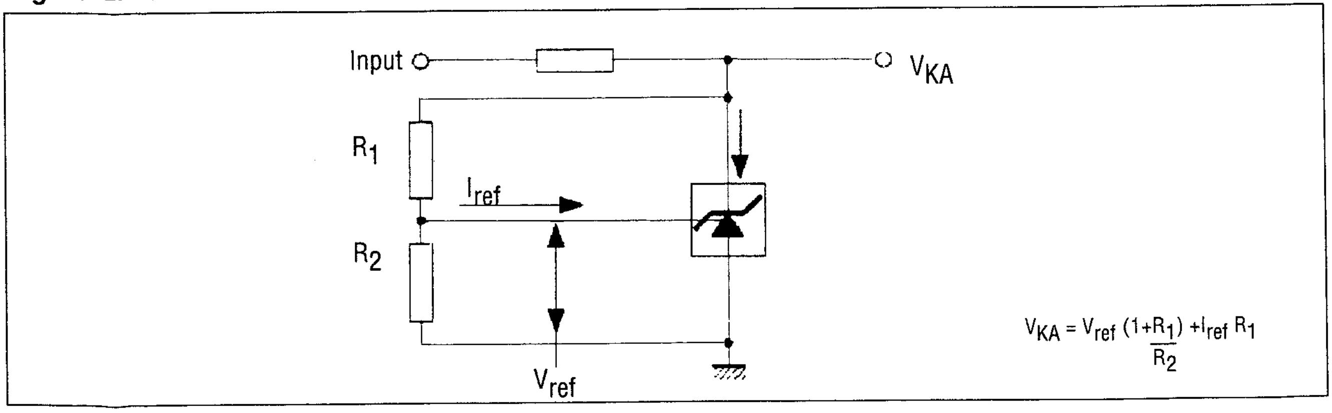


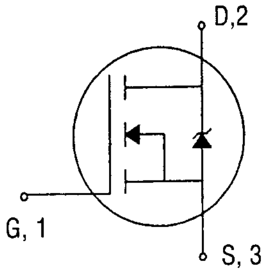
Figure 2: Test Circuit for VKA > Vref

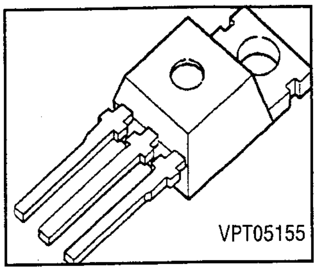


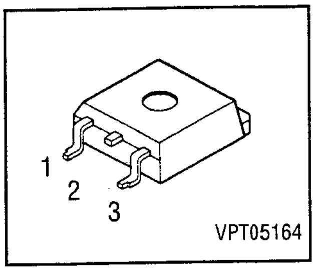
$$V_{KA} = V_{ref}\,(1+\frac{R_1}{R_2}) + I_{ref}\,R_1$$

SPP03N60S5 / SPB03N60S5
Cool MOS Power Transistor

- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche proved
- Extreme d*v*/d*t* rated
- Optimized capacitances
- Improved noise immunity
- Former development designation:
  SPPx4N60S5/SPBx4N60S5







Type	V_{DS}	I_D	$R_{DS(on)}$	Package	Marking	Ordering Code
SPP03N60S5	600V	3.2A	1.4Ω	P-TO220-3-1	03N60S5	Q67040-S4184
SPB03N60S5				P-TO263-3-2	03N60S5	Q67040-S4197

MAXIMUM RATINGS

at T_j = 25 °C; unless otherwise specified

Parameter	Symbol	Value	Unit
Continuous drain current T_C = 25 °C T_C = 100 °C	I_D	 3.2 2	A
Pulsed drain current, tp = 1ms (1) T_C = 25 °C	$I_{D\ puls}$	5.7	
Avalanche energy, single pulse I_D =3.2A, V_{DD} = 50V, R_{GS} = 25Ω Periodic avalanche energy E_{AR} only limited by T_{jmax}	E_{AS}	100	mJ
Reverse diode d_v/d_t IS = 3.2 A, V_{DS}<V_{DSS}, d_i/d_t = 100 A/µs, T_{jmax} = 150 °C	d_v/d_t	6	kV/µs
Gate source voltage	V_{GS}	±20	V
Power dissipation T_C = 25 °C	P_{tot}	38	°C
Operating and storage temperature	T_j, T_{stg}	-55 ...+150	°C

ELECTRICAL CHARACTERISTICS

Parameter at T_j = 25 °C; unless otherwise specified	**Symbol**	**Value**			**Unit**
		min.	**typ.**	**max.**	

Thermal Characteristics

Thermal resistance, junction - case	R_{thJC}	–	–	3.3	K/W
Thermal resistance, junction - ambient (Leaded and through-hole packages)	R_{thJA}	–	–	62	
SMD version, device on PCB @ min. footprint @ 6 cm² cooling area (2)	RthJA	 – –	 – 35	 62 –	

Static Characteristics

Drain-source breakdown voltage V_{GS} = 0V, I_D = 0.25 mA	$V_{(BR)DSS}$	600	–	–	V
Gate threshold voltage, V_{GS} = V_{DS} I_D = 135 µA, T_j = 25 °C	$V_{GS(th)}$	3.5	4.5	5.5	
Zero gate voltage drain current, V_{DS} = V_{DSS} V_{GS} = 0V, T_j = 25 °C V_{GS} = 0V, T_j = 150 °C	I_{DSS}	 – –	 0.5 –	 1 70	µA
Gate-source leakage current V_{GS} = 20V, V_{DS} = 0V	I_{GSS}	–	–	100	nA
Drain Source on-state resistance V_{GS} = 10V, I_D = 2A	$R_{DS(on)}$	–	1.26	1.4	Ω

---

[1] current limited by T_{jmax}

[2] Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6 cm2 (one layer, 70µm thick) copper area for drain connection. PCB is vertical without blown air.

ELECTRICAL CHARACTERISTICS

Parameter at T_j = 25 °C; unless otherwise specified	**Symbol**	**Value**			**Unit**
		min.	**typ.**	**max.**	

Characteristics

Transconductance $V_{DS} \geq 2 * I_D *$ RDS(on)max, I_D = 2 A	g_{fs}	–	1.8	–	S
Input capacitance V_{GS} = 0V, V_{DS} = 25V, f = 1MHz	C_{iss}	–	440	–	pF
Output capacitance V_{GS} = 0V, V_{DS} = 25V, f = 1MHz	C_{oss}	–	230	–	
Reverse transfer capacitance V_{GS} = 0V, V_{DS} = 25V, f = 1MHz	C_{rss}	–	12	–	
Turn-on delay time V_{DD} = 350V, V_{GS} = 10V, I_D = 3.2 A, R_G = 20 Ω	$t_{d(on)}$	–	40	–	ns
Rise time V_{DD} = 350V, V_{GS} = 10V, I_D = 3.2 A, R_G = 20 Ω	t_r	–	30	–	
Turn-on delay time V_{DD} = 350V, V_{GS} = 10V, I_D = 3.2 A, R_G = 20 Ω	$t_{d(off)}$	–	60	–	
Fall time V_{DD} = 350V, V_{GS} = 10V, I_D = 3.2 A, R_G = 20 Ω	t_f	–	30	–	

Gate Charge Characteristics

Gate-source charge I_D = 3.2 A, V_{DD} = 350V	Q_{gs}	–	3	–	nC
Gate-drain charge I_D = 3.2 A, V_{DD} = 350V	Q_{igd}	–	7.5	–	
Total gate charge V_{DD} = 350V, I_D = 3.2 A, f = 1MHz	Q_g	–	12.8	–	
Reverse transfer capacitance V_{GS} = 0V, V_{DS} = 25V, V_{GS} = 0 to 10 V,	C_{rss}	–	12	–	

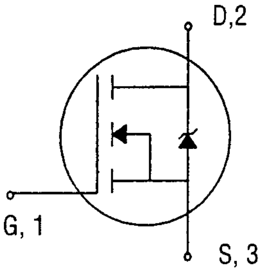
Reverse Diode

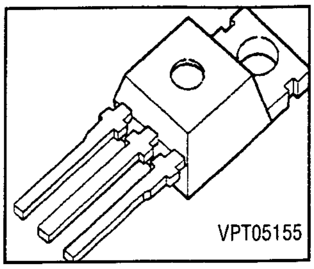
Inverse diode continuous forward current T_C = 25 °C	I_S	–	–	3.2	A
Inverse diode direct current, pulsed T_C = 25 °C	I_{SM}	–	–	5.7	
Inverse diode forward current V_{GS} = 0V, I_F = 3.2 A	V_{SD}	–	1	1.2	V
Reverse recovery time V_R = 350V, I_F = I_S, d_{iF} = 100 A/µs	f_{rr}	–	1000	–	ns
Reverse recovery charge V_R = 350V, I_F = I_S, $d_{iF/dt}$ = 100 A/µs	Q_{rr}	–	2.3	–	µC

SPP04N60S5 / SPB04N60S5

Cool MOS Power Transistor

- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche proved
- Extreme d_v/d_t rated
- Optimized capacitances
- Improved noise immunity
- Former development designation:
  SPPx6N60S5/SPBx6N60S5





Type	V_{DS}	I_D	$R_{DS(on)}$	Package	Marking	Ordering Code
SPP04N60S5	600V	4.5A	0.95Ω	P-TO220-3-1	04N60S5	Q67040-S4200
SPB04N60S5				P-TO263-3-2	04N60S5	Q67040-S4201

MAXIMUM RATINGS

at T_j = 25 °C; unless otherwise specified

Parameter	Symbol	Value	Unit
Continuous drain current T_C = 25 °C T_C = 100 °C	I_D	 4.5 2.8	A
Pulsed drain current, tp = 1ms (1) T_C = 25 °C	$I_{D\ puls}$	7.7	
Avalanche energy, single pulse I_D = 4.5A, V_{DD} = 50V, R_{GS} = 25Ω Periodic avalanche energy E_{AR} only limited by T_{jmax}	E_{AS}	130	mJ
Reverse diode d_v/d_t I_S = 4.5 A, $V_{DS}<V_{DSS}$, d_i/d_t = 100 A/µs, T_{jmax} = 150 °C	d_v/d_t	6	kV/µs
Gate source voltage	V_{GS}	±20	V
Power dissipation T_C = 25 °C	P_{tot}	50	W
Operating and storage temperature	T_j, T_{stg}	-55 ...+150	°C

ELECTRICAL CHARACTERISTICS

Parameter at T_j = 25 °C; unless otherwise specified	**Symbol**	**Value**			**Unit**
		min.	**typ.**	**max.**	

Thermal Characteristics

Thermal resistance, junction - case	R_{thJC}	–	–	2.5	K/W
Thermal resistance, junction - ambient (Leaded and through-hole packages)	R_{thJA}	–	–	62	
SMD version, device on PCB @ min. footprint @ 6 cm^2 cooling area (2)	RthJA	 – –	 – 35	 62 –	

Static Characteristics

Drain-source breakdown voltage V_{GS} = 0V, I_D = 0.25 mA	$V_{(BR)DSS}$	600	–	–	V
Gate threshold voltage, V_{GS} = V_{DS} I_D = 200 µA, T_j = 25 °C	$V_{GS(th)}$	3.5	4.5	5.5	
Zero gate voltage drain current, V_{DS} = V_{DSS} V_{GS} = 0V, T_j = 25 °C V_{GS} = 0V, T_j = 150 °C	I_{DSS}	 – –	 0.5 –	 1 50	µA
Gate-source leakage current V_{GS} = 20V, V_{DS} = 0V	I_{GSS}	–	–	100	nA
Drain Source on-state resistance V_{GS} = 10V, I_D = 2.8A	$R_{DS(on)}$	–	0.85	0.95	Ω

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[1] current limited by T_{jmax}

[2] Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6 cm2 (one layer, 70µm thick) copper area for drain connection. PCB is vertical without blown air.

ELECTRICAL CHARACTERISTICS

Parameter at T_j = 25 °C; unless otherwise specified	Symbol	Value			Unit
		min.	typ.	max.	

Characteristics

Transconductance $V_{DS} \geq 2 {}^* I_D {}^*$ RDS(on)max, I_D = 2.8 A	g_{fs}	–	2.5	–	S
Input capacitance V_{GS} = 0V, V_{DS} = 25V, f = 1MHz	C_{iss}	–	600	–	pF
Output capacitance V_{GS} = 0V, V_{DS} = 25V, f = 1MHz	C_{oss}	–	325	–	
Reverse transfer capacitance V_{GS} = 0V, V_{DS} = 25V, f = 1MHz	C_{rss}	–	15	–	
Turn-on delay time V_{DD} = 350V, V_{GS} = 10V, I_D = 4.5 A, R_G = 18 Ω	$t_{d(on)}$	–	40	–	ns
Rise time V_{DD} = 350V, V_{GS} = 10V, I_D = 4.5 A, R_G = 18 Ω	t_r	–	20	–	
Turn-on delay time V_{DD} = 350V, V_{GS} = 10V, I_D = 4.5 A, R_G = 18 Ω	$t_{d(off)}$	–	60	–	
Fall time V_{DD} = 350V, V_{GS} = 10V, I_D = 4.5 A, R_G = 18Ω	t_f	–	20	–	

Gate Charge Characteristics

Gate-source charge I_D = 4.5 A, V_{DD} = 350V	Q_{gS}	–	4.1	–	nC
Gate-drain charge I_D = 4.5 A, V_{DD} = 350V	Q_{igd}	–	9.2	–	
Total gate charge V_{DD} = 350V, I_D = 4.5 A, V_{GS} = 0 to 10 V	Q_g	–	17	–	

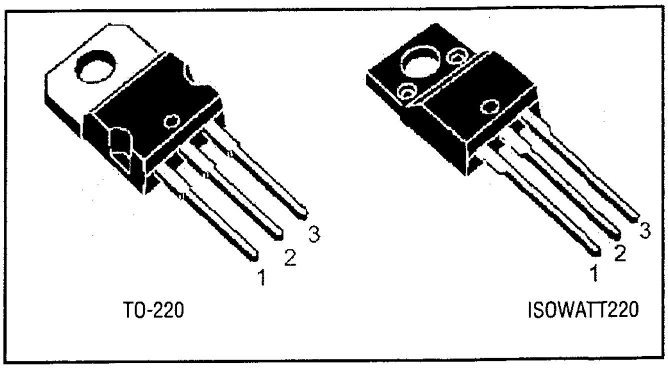
Reverse Diode

Inverse diode continuous forward current T_C = 25 °C	I_S	–	–	4.5	A
Inverse diode direct current, pulsed T_C = 25 °C	I_{SM}	–	–	7.7	
Inverse diode forward current V_{GS} = 0V, I_F = 4.5 A	V_{SD}	–	1	1.2	V
Reverse recovery time V_R = 350V, I_F = I_S, $d_{iF/dt}$ = 100 A/µs	f_{rrr}	–	900	–	ns
Reverse recovery charge V_R = 350V, I_F = I_S, $d_{iF/dt}$ = 100 A/µs	Q_{rrr}	–	3.2	–	µC

L7805

Positive Voltage Regulators

- Output current up to 1.5 A
- Output Voltagesof 5V
- Thermal Overload Protection
- Shortcircuit protection
- Output transition soa protection



DESCRIPTION

The L7800 series of three-terminal positive regulators is available in TO-220 ISOWATT220 TO-3 and D2 PAK packages and several fixed output voltages, making it useful in a wide range of applications. These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type employs internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

ABSOLUTE MAXIMUM RATINGS

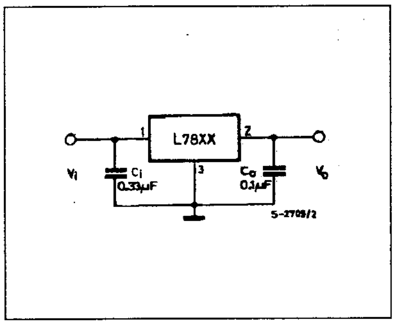
Symbol	Parameter		Value	Unit
V_i	DC input voltage (for Vo = 5 to 18V)		35	V
	(for Vo = 20, 24V)		40	V
I_o	Output current		internally limited	
P_{tot}	Power Dissipation		internally limited	
T_{op}	Operating Junction Temperature Range	(for L7800)	-55 to 125	°C
		(for L7800C)	0 to 150	°C
T_{stg}	Storage Temperature Range		-40 to 150	°C

ELECTRICAL CHARACTERISTICS For L7805 (refer to the test circuits, T_j = -55 to 150 °C Vi = 10V, Io = 500 mA, Ci = 0.33 µF, Co = 0.1 µF unless otherwise specified)

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
Vo	Output Voltage	$T_j = 25$ °C	4.8	5	5.2	V
Vo	Output Voltage Vi = 8 to 20 V	I_O = 5 mA to 1 A $P_O \leq 15$W	4.65	5	5.35	V
ΔVo*	Line Regulation Vi = 8 to 12 V $T_j = 25$ °C	Vi = 7 to 25 V $T_j = 25$ °C	 1	3 25	50 mV	mV
ΔVo*	Load Regulation Io = 250 to 750 mA $T_j = 25$ °C	Io = 5 to 1500 mA $T_j = 25$ °C		 25	100 mV	mV
Id	Quiescent Current	$T_j = 25$ °C			6	mA
ΔId	Quiescent Current Change	Io = 5 to 1000 mA			0.5	mA
ΔId	Quiescent Current Change	Vi = 8 to 25V			0.8	mA
$\frac{\Delta Vo}{\Delta T}$	Output Voltge Drift	Io = 5 mA		0.6		mV/°C
eN	Output Noise Voltage	B = 10Hz to 100 kHz $T_j = 25$ °C			40	µV/Vo
SVR	Supply Voltage Rejection	Vi = 8 to 18V f= 120 Hz	68			dB
Vd	Dropout Voltage	Io = 1 A $T_j = 25$ °C		2	2.5	V
Ro	Output Resistance	f = 1kHz		17		mΩ
Isc	Short Circuit Current	Vi = 35V $T_j = 25$ °C		0.75	1.2	A
Iscp	Short Circuit Peak Current	$T_j = 25$ °C	1.3	2.2	3.3	A

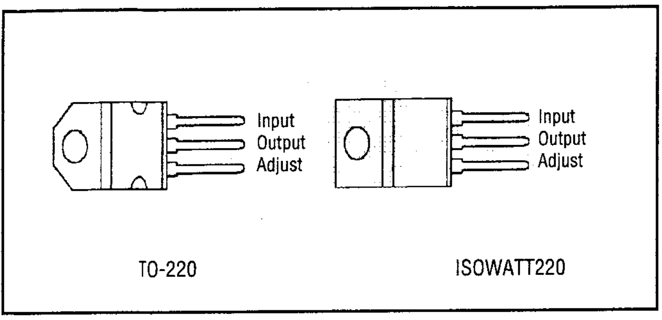
TEST CIRCUITS

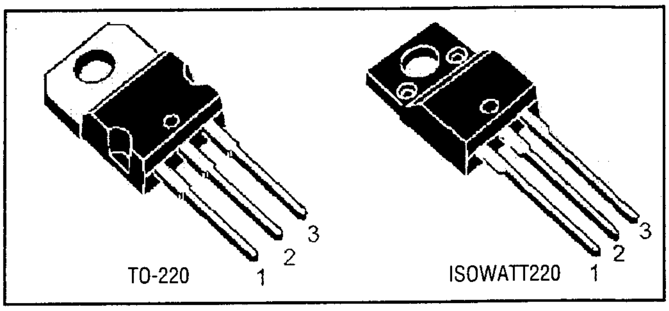
Figure 1: DC Parameter



LM317

1.2V to 37V Voltage Regulator





- Output Voltagerange : 1.2 to 37V
- Output Current in Excessof 1.5 A
- 0.1% Line and Load Regulation
- Floating Operation for High Voltages
- Complete Series of Protections: Current Limiting, Thermal Shutdown and Soa Control

DESCRIPTION

The LM117 / LM217 / LM317 are monolithic integrated circuit in TO-220, ISOWATT220, TO-3 and D 2 PAK packages intended for use as positive adjustable voltage regulators. They are designed to supply more than 1.5A of load current with an output voltage adjustable over a 1.2 to 37V range. The nominal output voltage is selected by means of only a resistive divider, making the device exceptionally easy to use and eliminating the stocking of many fixed regulators.

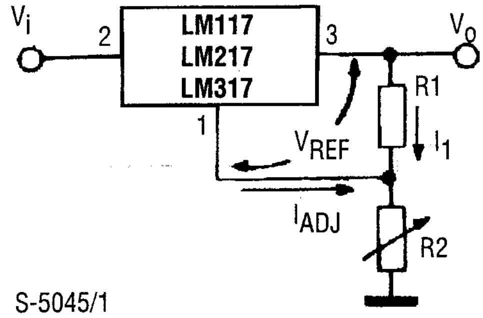
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{i-o}	Input - output differential voltage	40	V
I_O	Output current	internally limited	
T_{op}	Operating Junction Temperature for: LM117	-55 to 150	°C
	LM217	-25 to 150	°C
	LM317	0 to 125	°C
P_{tot}	Power Dissipation	internally limited	
T_{stg}	Storage Temperature	-65 to 150	°C

THERMAL DATA

Symbol	Parameter		TO-3	TO-220	ISOWATT220	D2PAK	Unit
Rthj-case	Thermal Resistance Junction - case	max.	4	3	4	3	°C/W
Rthj-amb	Thermal Resistance Junction-ambient	ma	35	50	60	62.5	°C/W

BASIC ADJUSTABLE REGULATOR



ELECTRICAL CHARACTERISTICS (V_i - V_o = 5V, I_o = 500 mA, I_{MAX} = 1.5A and P_{MAX} = 20W, unless otherwise specified)

Symbol	Parameters	Test Conditions		LM117/LM217			LM317			Unit
				Min.	Typ.	Max.	Min.	Typ.	Max.	
ΔVo	Line Regulation	Vi -Vo = 3 to 40 V	T_j = 25 °C		0.01	0.02		0.01	0.04	%/V
					0.02	0.05		0.02	0.07	%/V
ΔVo	Load Regulation	Vo ≤ 5V Io =10mA to I_{MAX}	T_j = 25 °C		5	15		5	25	mV
					20	50		20	70	mV
		Vo ≥ 5V Io =10mA to I_{MAX}	T_j = 25 °C		0.1	0.3		0.1	0.5	%
					0.3	1		0.3	1.5	%
I_{ADJ}	Adjustment Pin Current				50	100		50	100	µA
ΔI_{ADJ}	Adjustment Pin Current	Vi -Vo = 2.5 to 40 V Io =10mA to I_{MAX}			0.2	5		0.2	5	µA
VREF	Reference Voltage (between pin 3 and pin 1)	Vi -Vo = 2.5 to 40 V Io =10mA to I_{MAX} $P_D \leq P_{MAX}$		1.2	1.25	1.3	1.2	1.25	1.3	V
$\frac{\Delta Vo}{Vo}$	Output Voltage Temperature Stability				1			1		%
Io(min)	Minimum Load Current	Vi -Vo = 40 V			3.5	5		3.5	10	mA
Io(max)	Maximum Load Current	Vi -Vo ≤ 15 V $P_D < P_{MAX}$		1.5	2.2		1.5	2.2		A
		Vi -Vo = 40 V $P_D < P_{MAX}$ T_j = 25 °C			0.4			0.4		A
eN	Output Noise Voltage (percentance of Vo)	B = 10Hz to 10 kHz T_j = 25 °C			0.003			0.003		%
SVR	Supply Voltage Rejection (*)	T_j = 25 °	C_{ADJ} = 0		65			65		dB
		f = 120 Hz	C_{ADJ} = 10 µF	66	80		66	80		dB

(*) *CADJ is connected between pin 1 and ground.*

Notes: 1. *Unless otherwise specified the above specs, apply over the following conditions: LM117 Tj = -55 to 150 °C; LM217 Tj = -25 to 150 °C; LM317 Tj = 0 to 125 °C;*

BU508AF

Silicon Diffused Power Transistor

GENERAL DESCRIPTION

High voltage, high-speed switching npn transistor in a fully isolated SOT199 envelope, primarily for use in horizontal deflection circuits of colour television receivers.

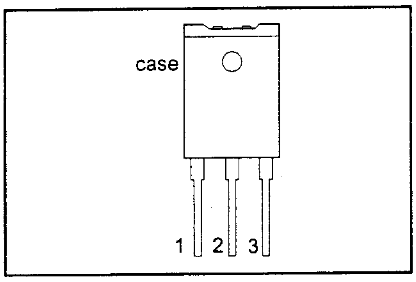
QUICK REFERENCE DATA

Symbol	Parameter	Conditions	Typ.	Max.	Unit
V_{CESM}	collector - emitter voltage peak value	V_{BE} = 0V	–	1500	V
V_{CEO}	collector - emitter voltage (open base)		–	700	V
I_C	collector current (DC)		–	8	A
I_{CM}	collector current peak value		–	15	A
P_{tot}	total power dissipation	$T_{hs} \leq 25$ °C	–	34	W
V_{CEsat}	collector - emitter saturation voltage	I_C = 4.5 A; I_B = 1.6 A	–	1.0	V
I_{Csat}	collector saturation current	f = 16kHz	4.5	–	A
t_f	fall time	I_{Csat} = 4.5 A; f = 16kHz	0.7	–	µs

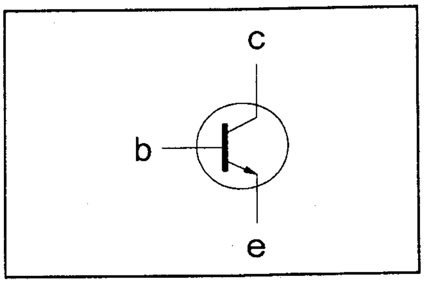
PINNING - SOT199

Pin	Description
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

Symbol	Parameter	Conditions	Typ.	Max.	Unit
V_{CESM}	collector - emitter voltage peak value	V_{BE} = 0V	–	1500	V
V_{CEO}	collector - emitter voltage (open base)		–	700	V
I_C	collector current (DC)		–	8	A
I_{CM}	collector current peak value		–	15	A
I_B	Base current (DC)		–	4	A
I_{BM}	Base current peak value		–	6	A
P_{tot}	Total power dissipation	$T_{hs} \leq 25$ °C	–	34	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		–	150	°C

THERMAL RESISTANCES

Symbol	Parameter	Conditions	Typ.	Max.	Unit
$R_{th\ j\text{-}hs}$	Junction to heatsink	without heatsink compound	–	3.7	K/W
$R_{th\ j\text{-}hs}$	Junction to heatsink	with heatsink compound	–	2.8	K/W
$R_{th\ j\text{-}a}$	Junction to ambient	in free air	35	–	K/W

ISOLATION LIMITING VALUE & CHARACTERISTICS

T_{hs} = 25 °C; unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H.≤ 65%; clean and dustfree	–		2500	V
C_{isol}	Capaticance from T2 to external heatsink	f= 1 MHz	–	22	–	pF

STATIC CHARACTERISTICS

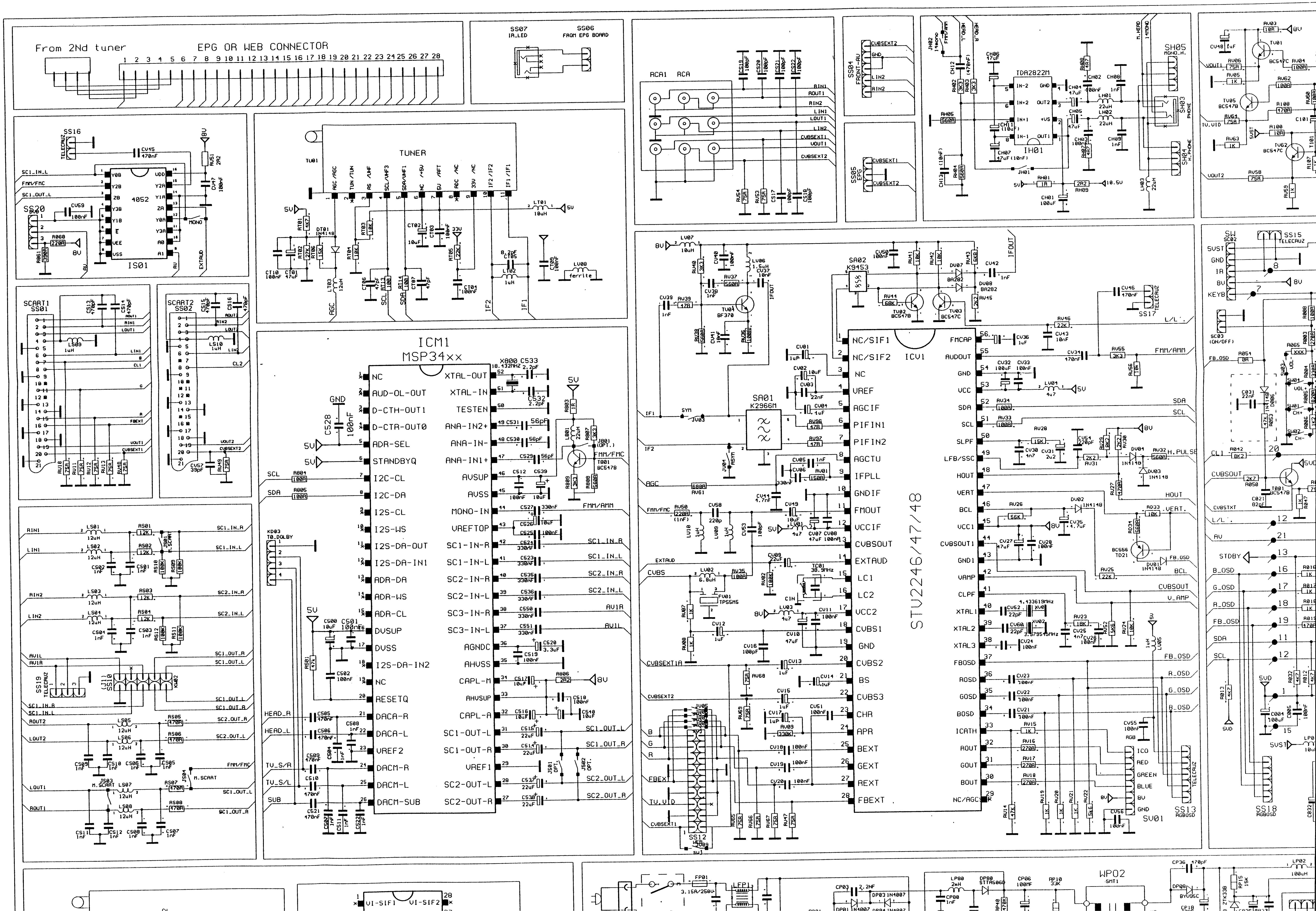
T_{hs} = 25 °C; unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{ces}	Collector cut-off current [1]	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	–	–	1.0	mA
I_{ces}		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$[2] T_j = 125 °C	–	–	2.0	mA
I_{EBO}	Emitter cut-off current	V_{EB} = 6.0 V; I_C = 0A	–	–	10	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	I_B = 0A; I_c = 100 mA; L = 25 mH	700	–	–	V
V_{CEsat}	Collector-emitter saturation voltages	I_C = 4.5 A; I_B = 1.6 A;	–	–	1.0	V
V_{BEsat}	Base-emitter saturation voltages	I_C = 4.5 A; I_B = 2 A;	–	–	1.1	V
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	6	13	30	

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C; unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
f_T	Transition frequency at f= 5 MHz	Ic= 0.1 A; VCE = 5 V	7	–	MHz
C_c	Collector capacitance at f= 5 MHz	V_{CB} = 10V	125	–	pF
	Switching times (16 kHz line deflection circuit)	I_{Csat} = 4.5 A; L_c 1 mH;; C_{fb} = 4 nF $I_{B(end)}$ = 1.4 A; L_B = 6 μH; -V_{BB} = -4 V; -I_{BM} = 2.25A			
t_s	Turn-off storage time		6.5	–	μs
t_f	Turn-off fall time		0.7	–	μs



From 2Nd tuner
EPG OR WEB CONNECTOR
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
SS07 IR_LED
SS06 FROM EPG BOARD
RCA1 RCA
RIN1
ROUT1
RIN2
LIN1
LOUT1
LIN2
CVBSEXT1
VOUT1
CVBSEXT2
CS19 100pF
CS20 100pF
CS21 100pF
CS22 100pF
RV54 75R
RV53 75R
CS17 100pF
CS18 100pF
SS04 FRONT-AV
SS05 EPG
CVBSEXT2
CVBSEXT1
GND
LIN2
RIN2
TDA2822M
IH01
IN-2
IN+2
IN+1
IN-1
OUT2
OUT1
+VS
GND
SH05 MONO_H.
SH03 PHONE
SH04 H.PHONE
RH05 560R
RH01 1R
RH09 2R2
10.5V
LH01 22uH
LH02 22uH
LH03 22uH
CH01 100uF
CH05 47uF
CH04 47uF
CH02 100nF
CH08 1nF
CH09 1nF
CH06 47uF
CH07 47uF (10nF)
CH11 (10uF)
JH01
JH02
HEAD_L
HEAD_R
M.HEAD
MONO
SS16 TELECRUZ
SC1_IN_L
FMM/FMC
SC1_OUT_L
SS20
4052
IS01
Y0B
Y2B
ZB
Y3B
Y1B
E
VEE
VSS
VDD
Y2A
Y1A
ZA
Y0A
Y3A
A0
A1
CV45 470nF
RV51 2R2
CV47 100nF
CV59 100nF
RV060 220R
RV061 390R
8V
MONO
EXTAUD
TUNER
TU01
AGC/AGC
TUN/TUN
AS/UHF
SCL/UHF3
SDA/UHF1
NC/+5V
5V/AFT
ADC/NC
33V/NC
IF2/IF2
IF1/IF1
LT01 10uH
LT02 1uH
LT03 12uH
DT01 1N4148
RT01 4K7
RT02 22K
RT06 15K
RT03 10K
RT04 10K
RT05 22K
RT11 100R
RT12 100R
CT01 47uF
CT10 100nF
CT02 10uF
CT03 100nF
CT04 100nF
CT05 8.2pF
CT06 47pF
CT07 47pF
CT09 100nF
LT00 ferrite
AGC
SCL
SDA
IF2
IF1
33V
SCART1 SS01
SCART2 SS02
CS13 470pF
CS14 470pF
CS15 470pF
CS16 470pF
LS09 1uH
LS10 1uH
CS57 33pF
RV10 75R
RV11 75R
RV12 75R
RV13 75R
RV48 75R
RV49 75R
ROUT1
RIN1
LOUT1
LIN1
CL1
CL2
FBEXT
VOUT1
VOUT2
CVBSEXT1
CVBSEXT2
RIN1
LIN1
RIN2
LIN2
LS01 12uH
LS02 12uH
LS03 12uH
LS04 12uH
RS01 12K
RS02 12K
RS03 12K
RS04 12K
JS01 M.SCART
RS09 100K
RS10 100K
RS11 100K
RS12 100K
CS01 1nF
CS02 1nF
CS03 1nF
CS04 1nF
SC1_IN_R
SC1_IN_L
SC2_IN_R
SC2_IN_L
AV1L
AV1R
SS19 TELECRUZ
SS10 (JI1)
KW02
SC1_OUT_R
SC1_OUT_L
SC2_OUT_R
SC2_OUT_L
ROUT2
LOUT2
LS05 12uH
LS06 12uH
LS07 12uH
LS08 12uH
RS05 470R
RS06 470R
RS07 470R
RS08 470R
JS03 M.SCART
JS04 M.SCART
CS05 1nF
CS06 1nF
CS07 1nF
CS08 1nF
CS09 1nF
CS10 1nF
CS11 1nF
CS12 1nF
LOUT1
ROUT1
ICM1
MSP34xx
NC
AUD-OL-OUT
D-CTH-OUT1
D-CTR-OUT0
ADR-SEL
STANDBYQ
I2C-CL
I2C-DA
I2S-CL
I2S-WS
I2S-DA-OUT
I2S-DA-IN1
ADR-DA
ADR-WS
ADR-CL
DVSUP
DVSS
I2S-DA-IN2
NC
RESETQ
DACA-R
DACA-L
VREF2
DACM-R
DACM-L
DACM-SUB
XTAL-OUT
XTAL-IN
TESTEN
ANA-IN2+
ANA-IN-
ANA-IN1+
AVSUP
AVSS
MONO-IN
VREFTOP
SC1-IN-R
SC1-IN-L
SC2-IN-R
SC2-IN-L
SC3-IN-R
SC3-IN-L
AGNDC
AHVSS
CAPL-M
AHVSUP
CAPL-A
SC1-OUT-L
SC1-OUT-R
VREF1
SC2-OUT-L
SC2-OUT-R
X800 18.432MHZ
C533 2.2pF
C532 2.2pF
C528 100nF
GND
KD03 TO_DOLBY
RA04 100R
RA05 100R
RS01 47K
C500 10uF
C501 100nF
C502 100nF
C505 470nF
C506 470nF
C508 1nF
C509 470nF
C510 470nF
C521 470nF
C507 1nF
C511 1nF
C522 1nF
C504 1nF
HEAD_R
HEAD_L
TV_S/R
TV_S/L
SUB
C531 56pF
C530 56pF
C529 56pF
C512 100nF
C539 10uF
C527 330nF
C526 10uF
C525 100nF
C524 330nF
C523 330nF
C535 330nF
C536 330nF
C550 330nF
C551 330nF
C520 3.3uF
C519 100nF
C517 10uF
C518 100nF
C516 10uF
C540 10uF
C515 22uF
C514 22uF
C537 22uF
C538 22uF
RA06 2R2
RA03 1R
RA07 3K3
RA09 33K
RA08 560R
LA01 22uH
JA01 (OPT.)
TA01 BC547B
FMM/FMC
FMM/AMM
JS01 OPT.
JS02 OPT.
SC1_IN_R
SC1_IN_L
SC2_IN_R
SC2_IN_L
AV1R
AV1L
SC1_OUT_L
SC1_OUT_R
SC2_OUT_L
SC2_OUT_R
8V
5V
ICV1
STV2246/47/48
NC/SIF1
NC/SIF2
NC
VREF
AGCIF
PIFIN1
PIFIN2
AGCTU
IFPLL
GNDIF
FMOUT
VCCIF
CVBSOUT
EXTAUD
LC1
LC2
VCC2
CVBS1
GND
CVBS2
BS
CVBS3
CHR
APR
BEXT
GEXT
REXT
FBEXT
FMCAP
AUDOUT
GND
VCC
SDA
SCL
SLPF
LFB/SSC
HOUT
VERT
BCL
VCC1
CVBSOUT1
GND1
VAMP
CLPF
XTAL1
XTAL2
XTAL3
FBOSD
ROSD
GOSD
BOSD
ICATH
ROUT
GOUT
BOUT
NC/AGC
SA01 K2966M
SA02 K9453
TV01 BF370
TV02 BC547B
TV03 BC547C
TD21 BC556
LV07 10uH
LV06 1.5uH
LV01 4u7
LV02 6.8uH
LV03 4u7
LV05 1uH
LV10
LV09
DV07 BA282
DV08 BA282
DV01 1N4148
DV02 1N4148
DV03 1N4148
DV04 1N4148
RV40 3K3
RV37 560R
RV39 47R
RV38 560R
RV36 100R
RV41 10K
RV42 10K
RV43 6K8
RV44 68K
RV45 2K2
RV46 22K
RV55 3K3
RV56 10K
RV34 100R
RV33 100R
RV28 15K
RV29 10K2
RV30 2K2
RV31 2K2
RV32 560R
RV27 270R
RV26 56K
RV25 22K
RV23 10K
RV24 10K
RV52 5K6
RD33 10K
RD34 560R
RV96 47R
RV97 47R
RV01 150R
RV61 680R
RV50 220R
RV35 100R
RV02 100K
RV07 1K
RV08 1K
RV09 330K
RV68
RV69 75R
RV65 75R
RV66 75R
RV67 75R
RV47 75R
RV14 47K
RV15 1K
RV16 270R
RV17 270R
RV18 270R
RV19 1K
RV20 1K
RV21 1K
RV22 5K6
CV01 1uF
CV02 10uF
CV03 22nF
CV04 1uF
CV05 1nF
CV06 1nF
CV07 47uF
CV08 100nF
CV09 22uF
CV10 47uF
CV11 100nF
CV12 1uF
CV13
CV14 1uF
CV15 1uF
CV16 100pF
CV17 1uF
CV18 100nF
CV19 100nF
CV20 100nF
CV21 100nF
CV22 100nF
CV23 100nF
CV24 100nF
CV25 4n7
CV26 100nF
CV27 47uF
CV28 100nF
CV30 4n7
CV31 2u2
CV32 100uF
CV33 100nF
CV34 470nF
CV35 4.7uF
CV36 1uF
CV37 10nF
CV38 1nF
CV39 1nF
CV40 100nF
CV41 10nF
CV42 1nF
CV43 10nF
CV44 4.7nF
CV46 470nF
CV49 10uF
CV51 100nF
CV52 22pF
CV53 100pF
CV54 220pF
CV55 100nF
CV56 10nF
CV58 220p
CV59 100nF
CV60 22pF
XV01 4.433619MHz
XV02 3.579545MHz
TC01 38.9MHz
FV01 TPS5MS
C1N
SYM
JV03
JV01 ASYM
IF1
IF2
AGC
FMM/FMC
EXTAUD
CVBS
CVBSEXT1
CVBSEXT2
B
G
R
FBEX
TV_VID
CVBSEXT1
SS12 WEB
JW05
SW1
1FOUT
SS17 TELECRUZ
L/L'
FMM/AMM
SDA
SCL
H.PULSE
HOUT
VERT.
FB_OSD
BCL
CVBSOUT
V_AMP
FB_OSD
R_OSD
G_OSD
B_OSD
RGB
ICO
RED
GREEN
BLUE
8V
GND
SV01
SS13 TELECRUZ
SS18 RGBOSD
RV03 10R
TV01 BC547C
TV05 BC547B
TV62 BC547C
RV06 75R
RV05 1K
RV04 100R
RV62 100R
R100 470R
RV61 75R
RV63 1K
R100 10R
RV58 75R
RV59 1K
CV18 1uF
VOUT1
VOUT2
TV_VID
SVST
SW SC02
SS15 TELECRUZ
SVST
GND
IR
8V
KEYB
SC03 (ON/OFF)
FB_OSD
RA054 0R
RA042 8K2
R058 2K7
C021 82pF
T001 BC547B
CVBSOUT
CVBSTXT
CL1
L/L'
AV
STDBY
B_OSD
G_OSD
R_OSD
FB_OSD
SDA
SCL
RA013 4K7
C031 22nF
C004 100uF
C005 100nF
20
12
21
13
16
17
18
19
11
12
15
7
8
FP01 3.15A/250V
LF01
CP03 2.2NF
DP01 1N4007
DP03 1N4007
LP80 2mH
DP80 STTA506D
CP80 1nF
CP06 100nF
RP10 33K
WP02 SMT1
CP36 470pF
LP02 100uH
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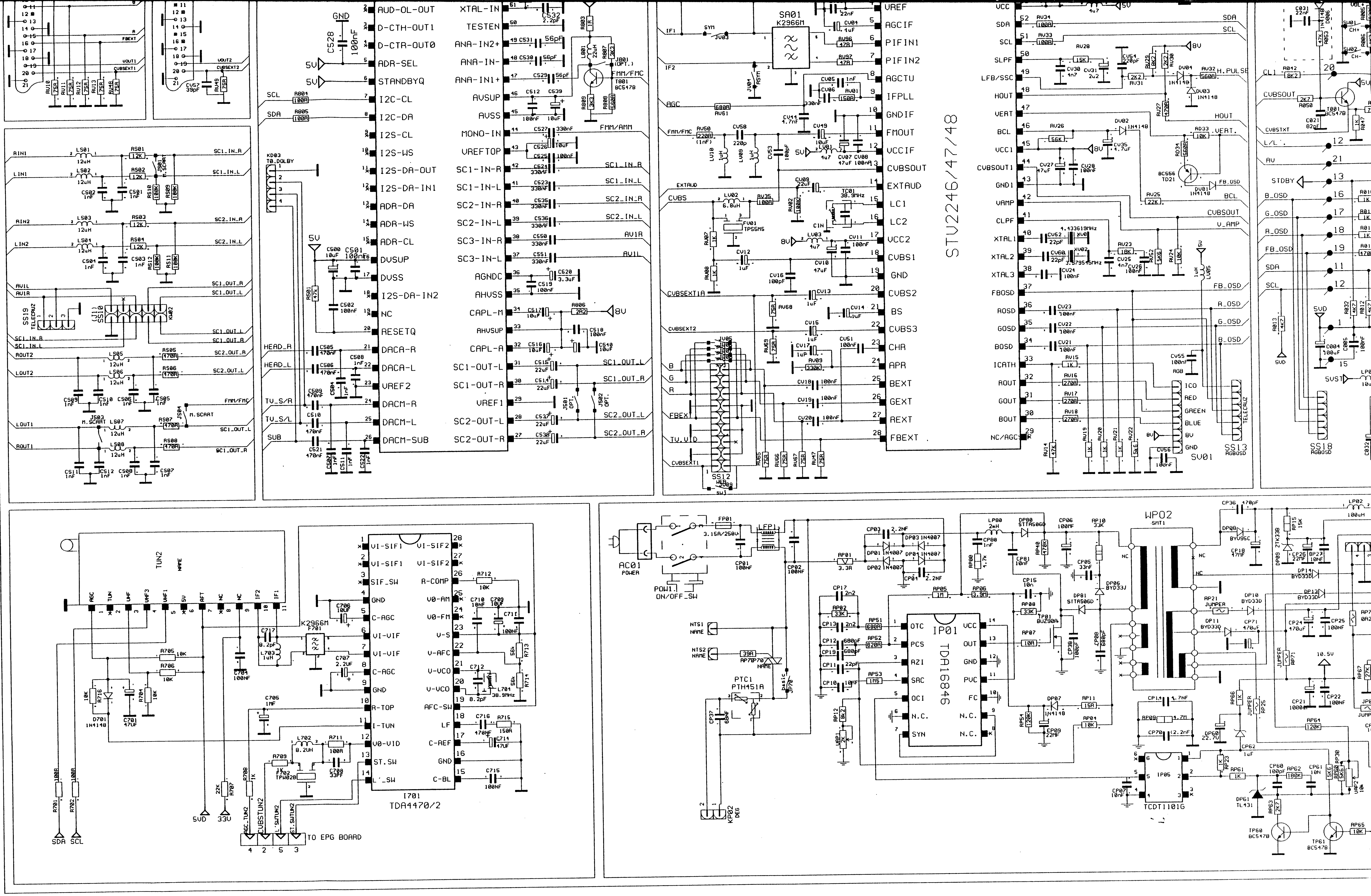
ZTK33B
RP15 15K
VI-SIF1
VI-SIF2
28
1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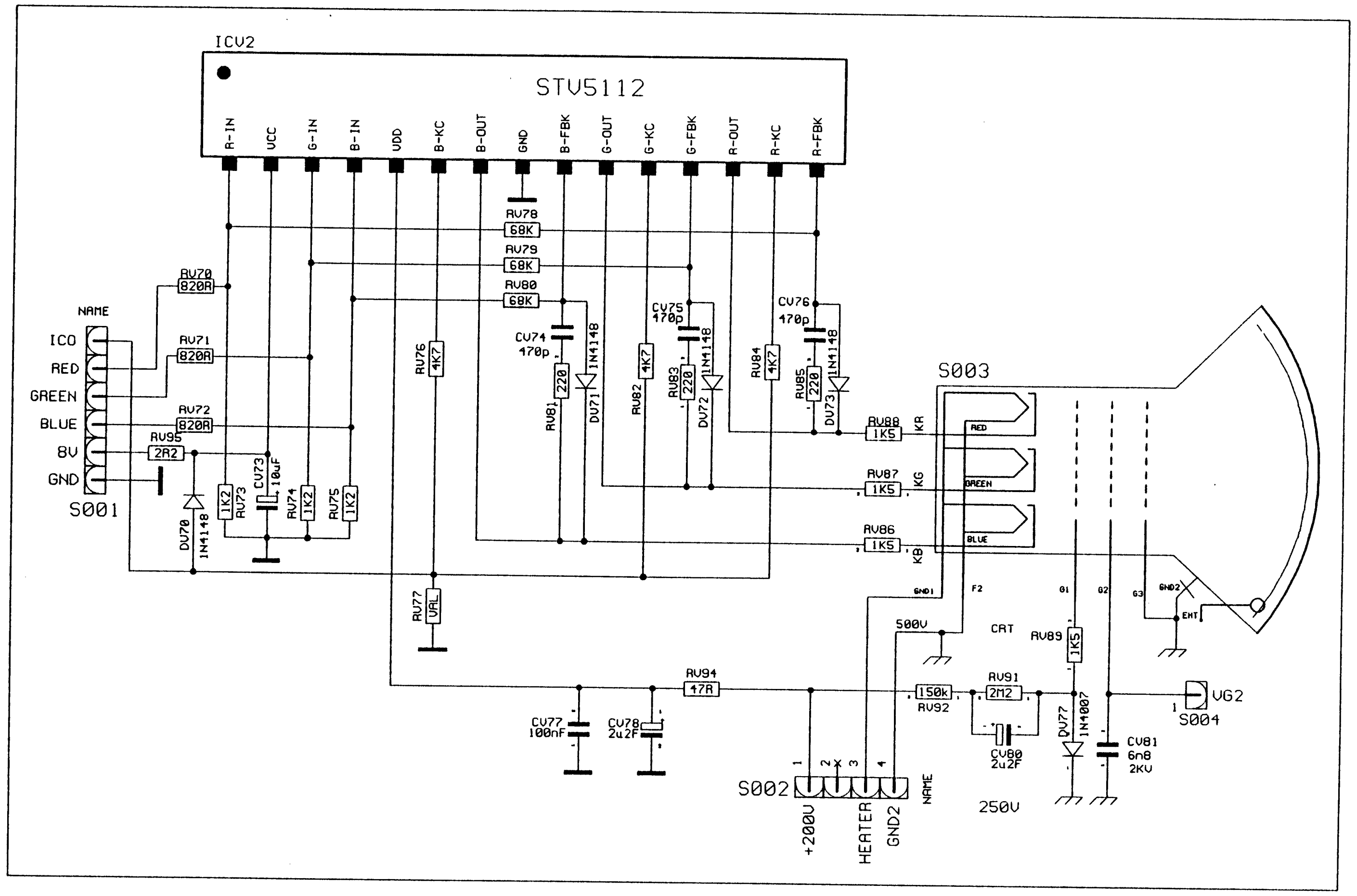
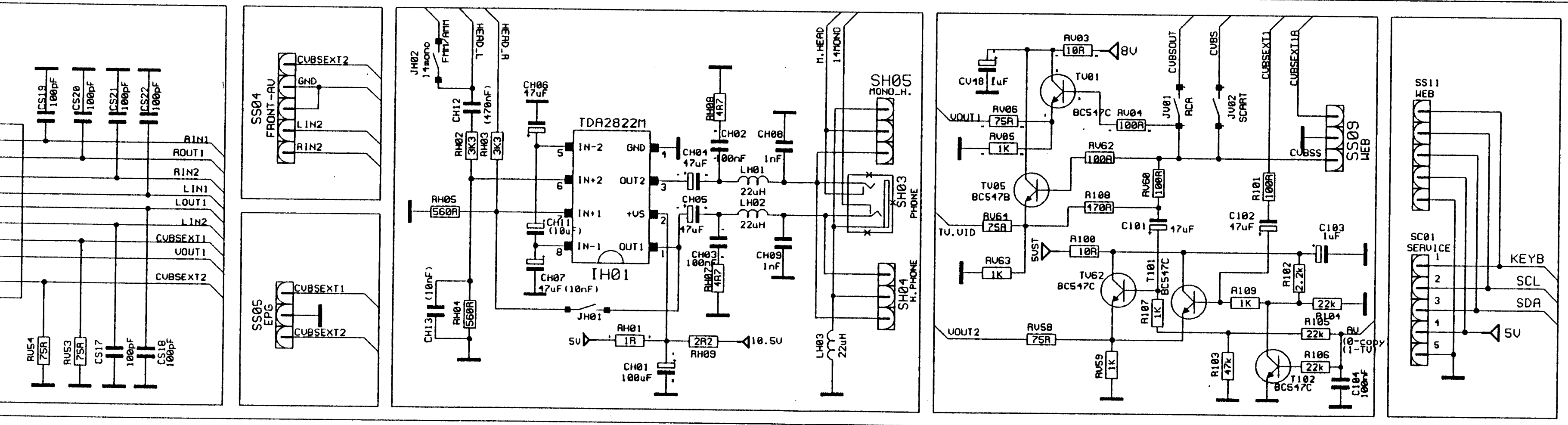
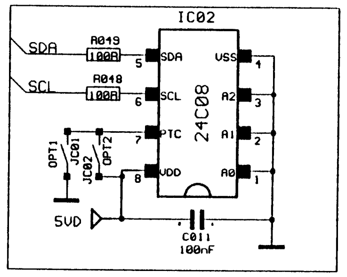
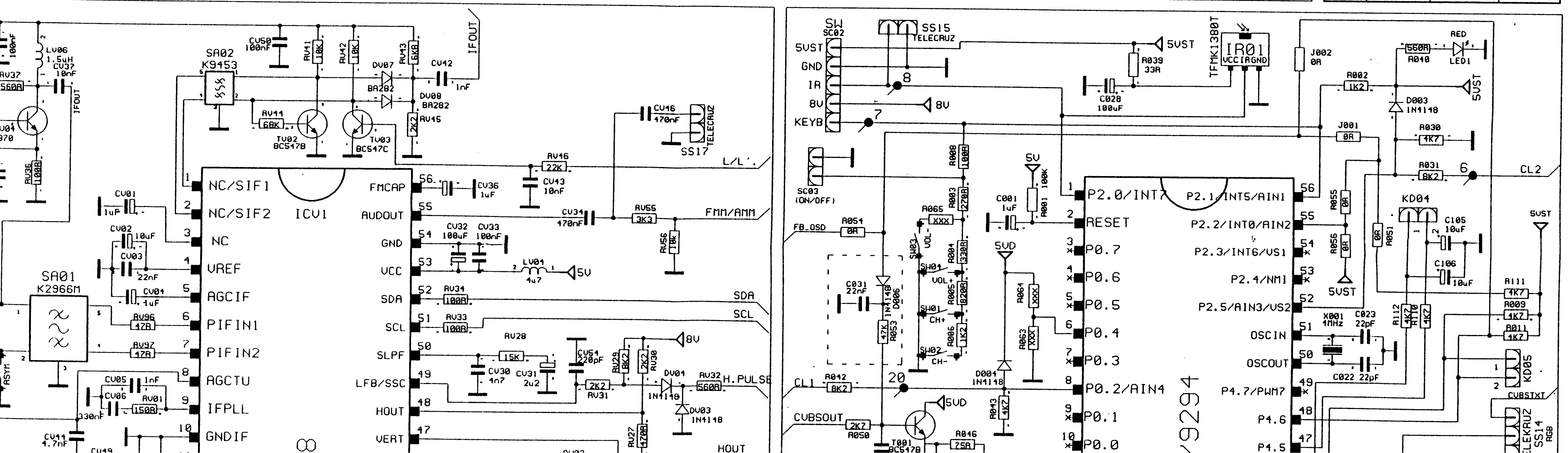
D-CTH-OUT1
D-CTR-OUT0
ADR-SEL
STANDBYQ
I2C-CL
I2C-DA
I2S-CL
I2S-WS
I2S-DA-OUT
I2S-DA-IN1
ADR-DA
ADR-WS
ADR-CL
DVSUP
DVSS
I2S-DA-IN2
NC
RESETQ
DACA-R
DACA-L
VREF2
DACM-R
DACM-L
DACM-SUB
XTAL-IN
TESTEN
ANA-IN2+
ANA-IN-
ANA-IN1+
AVSUP
AVSS
MONO-IN
VREFTOP
SC1-IN-R
SC1-IN-L
SC2-IN-R
SC2-IN-L
SC3-IN-R
SC3-IN-L
AGNDC
AHVSS
CAPL-M
AHVSUP
CAPL-A
SC1-OUT-L
SC1-OUT-R
VREF1
SC2-OUT-L
SC2-OUT-R
FMM/FMC
FMM/AMM
KD03 TO_DOLBY
GND
5V
8V
SCL
SDA
HEAD_R
HEAD_L
TV_S/R
TV_S/L
SUB
RIN1
LIN1
RIN2
LIN2
AVIL
AVIR
SS19 TELECAU2
SS10
SC1_IN_R
SC1_IN_L
SC2_IN_R
SC2_IN_L
SC1_OUT_R
SC1_OUT_L
SC2_OUT_R
SC2_OUT_L
ROUT1
ROUT2
LOUT1
LOUT2
M.SCART
FBEXT
VOUT1
VOUT2
CVBSEXT1
CVBSEXT2
SA01 K2966M
IF1
IF2
AGC
EXTAUD
CVBS
FMM/FMC
SYM
ASYM
STV2246/47/48
VREF
AGCIF
PIFIN1
PIFIN2
AGCTU
IFPLL
GNDIF
FMOUT
VCCIF
CVBSOUT
EXTAUD
LC1
LC2
VCC2
CVBS1
GND
CVBS2
BS
CVBS3
CHR
APR
BEXT
GEXT
REXT
FBEXT
VCC
SDA
SCL
SLPF
LFB/SSC
HOUT
VERT
BCL
VCC1
CVBSOUT1
GND1
VAMP
CLPF
XTAL1
XTAL2
XTAL3
FBOSD
ROSD
GOSD
BOSD
ICATH
ROUT
GOUT
BOUT
NC/AGC
H.PULSE
FB_OSD
V_AMP
R_OSD
G_OSD
B_OSD
RGB
ICO
RED
GREEN
BLUE
SV01
SS12
SS13 RGBOSD
SS18 RGBOSD
TEL1 CAU2
STDBY
CL1
CVBSOUT
CVBSTXT
L/L'
AV
TUN2
AGC
TUN
UHF
VHF3
VHF1
5V
AFT
NC
IF2
IF1
I701
TDA4470/2
VI-SIF1
SIF_SW
C-AGC
VI-VIF
R-TOP
I-TUN
V0-VID
ST.SW
L'_SW
VI-SIF2
R-COMP
V0-AM
V0-FM
V-S
V-AFC
V-VCO
AFC-SW
LF
C-REF
C-BL
K2966M F701
38.9MHz
5VD
33V
SDA
SCL
AGC_TUN2
CVBSTUN2
L'SWTUN2
ST.SWTUN2
TO EPG BOARD
AC01 POWER
POW1 ON/OFF_SW
FP01 3.15A/250V
LFP1
NTS1
NTS2
PTC1 PTH451A
KP02 DEG
IP01
TDA16846
OTC
PCS
RZI
SRC
OCI
N.C.
SYN
VCC
OUT
GND
PVC
FC
WP02 SMT1
IP05
TCDT1101G
DP61 TL431
TP60 BC547B
TP61 BC547B
TP01 BUZ90A
DP80 STTA506D
DP81 STTA506D
DP06 BYD33J
DP10 BYD33D
DP11 BYD33D
DP13 BYD33D
DP14 BYD33D
DP09 BYD95C
JUMPER
10.5V

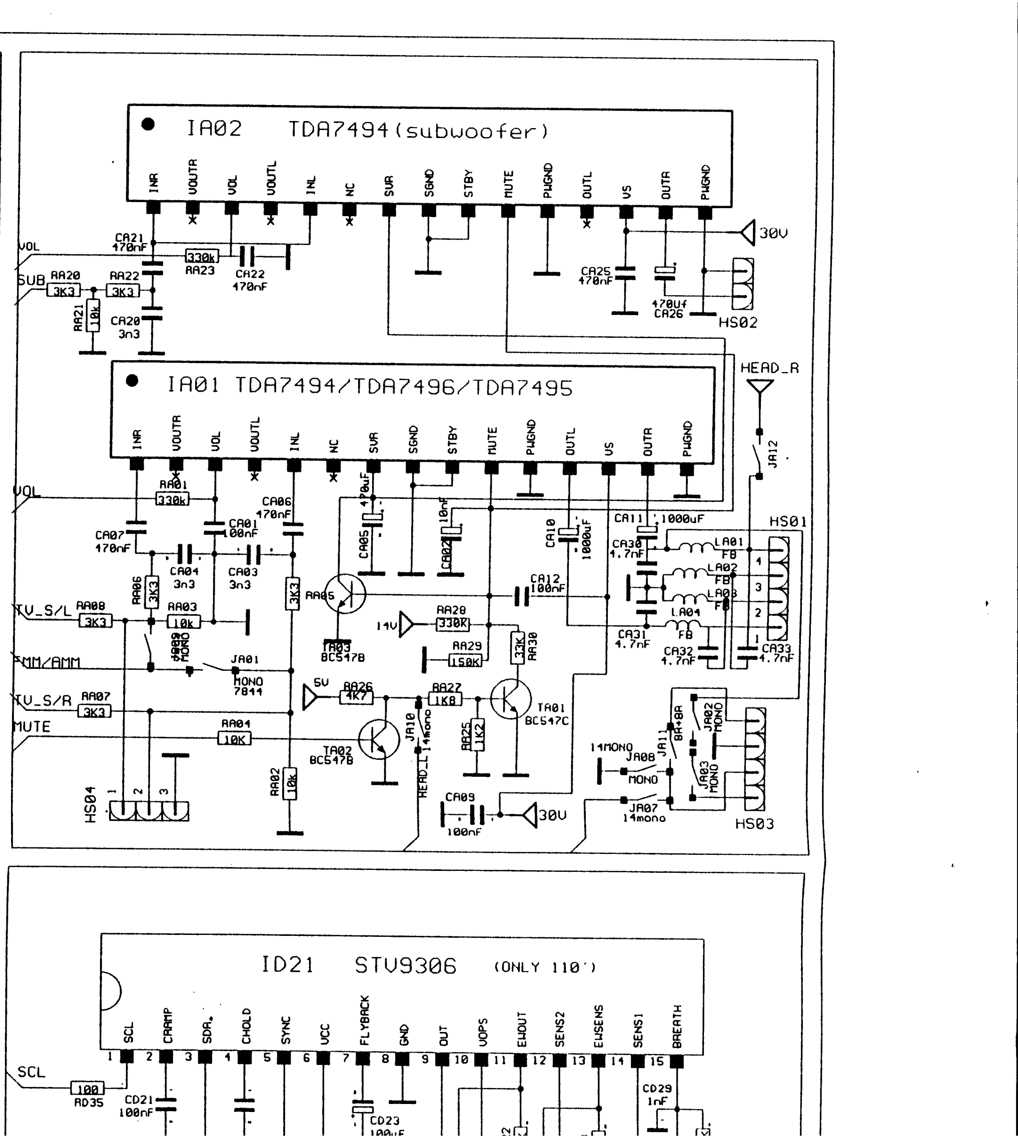

ICV2
STV5112
R-IN
VCC
G-IN
B-IN
VDD
B-KC
B-OUT
GND
B-FBK
G-OUT
G-KC
G-FBK
R-OUT
R-KC
R-FBK
S001
NAME
ICO
RED
GREEN
BLUE
8V
GND
S003
S002
+200V
HEATER
GND2
S004
VG2
CRT
500V
250V
RV70 820R
RV71 820R
RV72 820R
RV95 2R2
RV78 68K
RV79 68K
RV80 68K
RV86 1K5
RV87 1K5
RV88 1K5
RV89 1K5
RV94 47R
RV92 150k
RV91 2M2
CV77 100nF
CV78 2u2F
CV80 2u2F
CV81 6n8 2KV
DV77 1N4007
DV70 1N4148

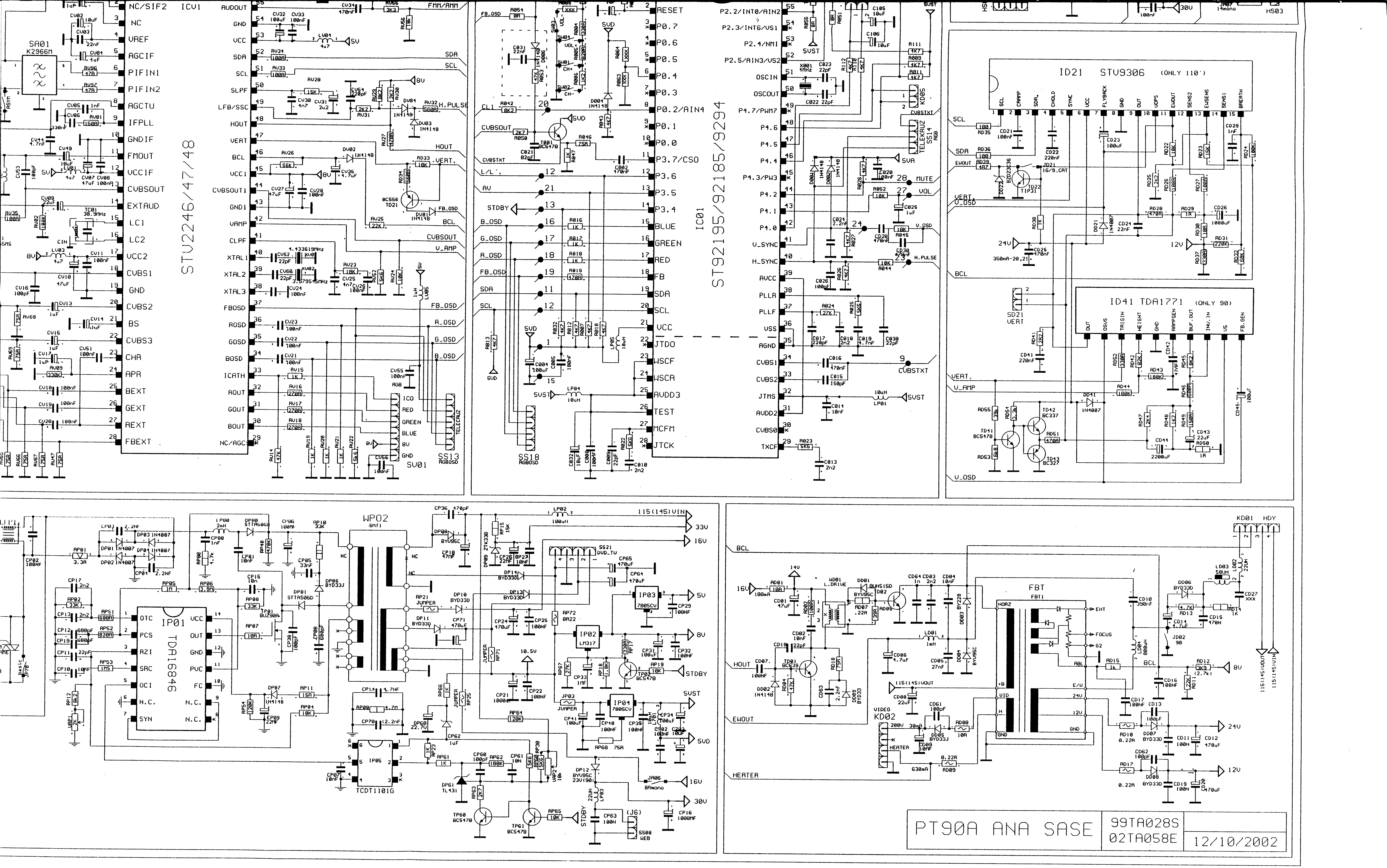

SS04 FRONT-AV
SS05 EPG
TDA2822M
IH01
SH05 MONO_H.
SH03 PHONE
SH04 H.PHONE
SS09 WEB
SS11 WEB
SC01 SERVICE
KEYB
SCL
SDA
5V
10.5V
8V
TV01 BC547C
TV05 BC547B
TV02 BC547C
T101 BC547C
T102 BC547C
CVBSEXT1
CVBSEXT2
AIN1
AOUT1
AIN2
LIN1
LOUT1
LIN2
VOUT1
VOUT2
TV.VID


IC02
24C08
SDA
SCL
PTC
VDD
VSS
A2
A1
A0
R019 100R
R018 100R
C011 100nF
5VD

	ST92195 TXT	ST92185 NO TXT	ST9294 CC
R24	-	5K6	27K
R25	5K6	5K6	6K8
C17	JUMPER	22pF	220pF
C18	-	4n7	2n2
C19	470nF	4n7	JUMPER
C30	-	22p	-


SA01 K2966M
SA02 K9453
ICV1
NC/SIF1
NC/SIF2
NC
VREF
AGCIF
PIFIN1
PIFIN2
AGCTU
IFPLL
GNDIF
FMCAP
AUDOUT
GND
VCC
SDA
SCL
SLPF
LFB/SSC
HOUT
VERT
IFOUT
L/L'
FMM/AMM
H.PULSE
SS17 TELECAUZ
SS15 TELECAUZ
SW SC02
5VST
GND
IR
8V
KEYB
SC03 (ON/OFF)
IR01 TFMK1380T
VCC IR GND
LED1 RED
KD04
KD05
SS14
P2.0/INT7
RESET
P0.7
P0.6
P0.5
P0.4
P0.3
P0.2/AIN4
P0.1
P0.0
P2.1/INT5/AIN1
P2.2/INT0/AIN2
P2.3/INT6/VS1
P2.4/NMI
P2.5/AIN3/VS2
OSCIN
OSCOUT
P4.7/PWM7
P4.6
P4.5
CL1
CL2
CVBSOUT
FB_OSD
X001 4MHz
T001 BC547B


IA02 TDA7494(subwoofer)
IA01 TDA7494/TDA7496/TDA7495
INR
VOUTR
VOL
VOUTL
INL
NC
SVR
SGND
STBY
MUTE
PWGND
OUTL
VS
OUTR
30V
14V
VOL
SUB
TV_S/L
FMM/AMM
TV_S/R
MUTE
HS01
HS02
HS03
HS04
HEAD_R
TA01 BC547C
TA02 BC547B
ID21 STV9306 (ONLY 110°)
SCL
CRAMP
SDA
CHOLD
SYNC
VCC
FLYBACK
GND
OUT
VOPS
EWOUT
SENS2
EWSENS
SENS1
BREATH


ICV1
STV2246/47/48
SA01 K2966M
IC01
ST92195/92185/9294
SS18 RGBOSD
SS13 TELECAUZ
SV01
SS14 TELECAUZ RGB
KD05
ID21 STV9306 (ONLY 110°)
ID41 TDA1771 (ONLY 90)
SD21 VERT
WP02 SMT1
IP01 TDA16846
IP02 LM317
IP03 7805CV
IP04 7805CV
IP05 TCDT1101G
SS21 DVD_TV
SS08 WEB
115(145)VIN
33V
16V
5V
8V
STDBY
5VST
30V
FBT
KD01 HDY
KD02 VIDEO
HEATER
EHT
FOCUS
G2
24V
12V
BCL
HOUT
EWOUT
PT90A ANA SASE
99TA028S
02TA058E
12/10/2002